

June 9, 1958

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Long Range

Pilot Report
On Skimmer IV



McDonnell F4H-1 With Sparrow III



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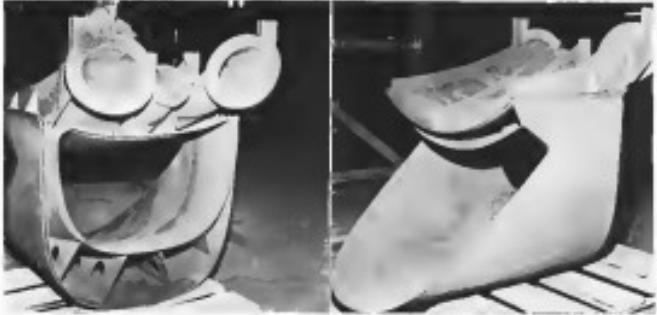
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Get a problem for which rubberized fabric might provide the answer? Why not talk it over with Goodyear—pioneer in making rubberized fabric to fit any application. Address: GoodYear, Aviation Products Division, Akron 15, Ohio, or Los Angeles 24, California.

GOOD **YEAR**
AVIATION PRODUCTS



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MAGNESIUM "SUGAR SCOOP" HELPS REGULUS II BREATHE

Huge thin-wolf neoplasms causing satisfies appetite for air

At elevations above ten miles above the earth, Claude Vaughn Averill's Biquette II contains enormous quantities of air. (Source: a 1950 U.S. patent application)

This complex, close tolerance magnesium casting supplies all for the Regulus' powerful J-75 jet engine. It also provides ducting for boundary layer control and for air conditioning. Nominal thicknesses on walls and webs is 0.34 inch and the inlet leading edge tapers to a 0.195 inch root radius. Casting tolerance is + or - .005 inch on dimensions up to 22 inches, with an additional + or - .002 inch per inch per side.

These discussions show that. That's real casting research! This air shop is an excellent example of the versatility and usefulness of magnesium alloy casting in aircraft design. Thin-walled casting designs can be produced in magnesium to replace complicated, costly fabrications involving several welding operations.

For more information about progressive mold castings and their use in aircraft design, contact your nearest magnesium foundry or Dove sales office.



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YOU CAN DEPEND ON



AVIATION CALENDAR

-

ANSWER 2010 National Survey Techniques

June 9, 1958
Mc. 48, Min. 22

Additional notes on Chrysanthemum
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The 4-123, with its 45-2000 cps operating range, is ideal for jet-engine monitoring where the basic frequency encountered is approximately 30 cycles. The 4-121 and 4-122 measure infraprop vibrations in the range of 15 cps to 2000 cps. Each type weighs only

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ASSOCIATED LEADS IN BALTIMORE—TELETYPE
PRESSURE AND VIBRATION INSTRUMENTATION

AVIATION CALENDAR

(Continued from page 5)

June 2-3—Society of the Automotive Engineers, National Summer Meeting, Air Inn Hotel, Los Angeles, Calif.
July 14-15—Tireless Inspection, National Advisory Committee for Aeronautics, Langley Research Center, Hampton, Va.
July 14-21—Planes of Informed Judgment Program for Aircraft Selection and Procurement, Massachusetts Institute of Technology, Cambridge, Mass.
July 24-25—Fifth Annual Symposium on Computer and Data Processing, Allis-Chalmers Hotel, Milwaukee, Wis.
Aug. 9-10—Regional Technical Meeting on Space Exploration, sponsored by American Rocket Society and the Institute of the Aerospace Sciences. For details: R. D. Lantz, General Chairman, Space Exploration, Moonbeam Hill, N. Marion Drive, San Dimas, Calif.
Aug. 16-18—Aerospace Technical Conference on Sun-Lunar Magnets and Magnetic Amplifiers, sponsored by the American Institute of Electrical Engineers, Hotel Statler, Los Angeles, Calif.
Aug. 18-21—Congress on Electronic Standards and Measurements, National Bureau of Standards, Boulder, Colo., jointly sponsored by NBS, National Institute of Standards and Technology, and Institute of Radio Engineers.

Aug. 17-21—Mobile Operations Research Institute Seminar, Pennsylvania State University, University Park, Pa.
Aug. 18-22—Modern Electronic Shows & Expositions, Institute of Radio Engineers, Hotel Statler, Los Angeles, Calif.
Aug. 23-25—Annual Congress of International Association of Aerodynamics, Bernhard, West Germany.
Sept. 1-7—1958 Fariborough Flight Display and Exhibition, Royal Air Force Airfield, Fariborough, Hampshire, Eng. (U.K.)

Sept. 7-12—1958 Congress Engineering, Danvers Manufacturing Institute of Technology, Cambridge, Mass.
Sept. 8-10—First International Congress of the American Society of Metals, Philadelphia, Pa.

Sept. 15-19—Annual Instrumentation Conference & Exhibit International, Instrument Society of America, Philadelphia Convention Hall, Philadelphia, Pa.
Sept. 22-24—1958 Meeting, Professional Group on Telemetry and Remote Control, Hotel Roosevelt, Hotel des Fleurs, Miami Beach, Fla.

Sept. 22-24—Second Annual Meeting, Standard Frequency Society, Benjamin Franklin Hotel, Philadelphia, Pa.
Sept. 25-Oct. 9—National Institute Meeting, Inst. of Automotive Engineers, Hotel Statler, Los Angeles, Calif.
Oct. 27-28—4th Annual Circuit Meeting of the International Av. Transport Assn., New Delhi, India.
Oct. 27-28—East Coast Conference on Non-rotating & Stepper Motors, Institute of Radio Engineers, Hotel Belmont, New York City.

HOW TO SOLVE AIRCRAFT AND COMPONENTS DESIGN PROBLEMS WITH



SILICONE IDEAS

Problem: Seal a high-temperature exhaust area that puffs back-and-forth like crazy.

Solution: We made with G-E silicone rubber insulation.

Exposed to 1500°F flame for hours, G-E silicone rubber insulation will not melt, however, if you roll it onto silicon dioxide, as asbestos can do, it will shrink and expand the way, as the laboratory experiment on the left shows. Silicote rubber has superior damping strength at high temperatures and keeps it for years. It stands up well to oil and fuel splashes, has low water absorption, is highly durable down to -70°F.

Check out the specimen for silicone rubber insulation and resistance wire, for it can take more flexing than standard wire, and much less than other high-temperature wires. Technical literature and names of qualified stay and cable manufacturers are available on request.

Problem: Design a flexible sheet capable of running flame, which will carry air at 700°F.

Solution: Specify G-E Class 700 silicone rubber.

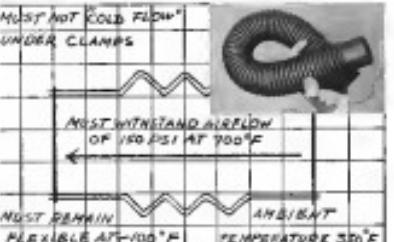
Problems like this are normal during engine starting and take-off heating ducts are being successfully solved with General Electric's improved Class 700 silicone rubber. With a service range from -230° to 700°F, flame and hot air temperatures up to 1500°F, oil and fuel temperatures up to 1000°F, and even flame air up to 700°F. Tests have shown resistance to common aircraft fuels and lubricants, including MIL-M-27008. Ducts and duct connectors made from G-E Class 700 silicone rubber exhibit low compressive set—will not "cold flow" under change, and with improved flame resistance, Class 700 is proving to be the ideal material for oil flexible hot air duct systems. G-E Class 700 silicone rubber is a valuable asset to almost every application. Technical data is requested.

Problem: Seal an hydraulic fluid tank function over the -32°F to 700°F range needed for future aircraft.

Solution: Versilube F-30, General Electric's new silicone fluid, with the best performance over the range of any hydraulic fluid now available.

Over the -32°F to 700°F range, just General Electric's new silicone fluid, Versilube F-30, provides adequate performance in all these areas. Versilube F-30 exhibits the best viscosity-temperature characteristics in the industry, and is the most stable silicone available, with a 10-year shelf life. No other serviceable hydraulic fluid matches the thermal stability of G-E Versilube F-30 up to 600°F and its use applications, up to 100°F. Its behavior is unequalled at temperatures as high as 700°F and comparable to other hydraulic fluids in the moderate range. Versilube F-30 also maintains a more nearly constant viscosity than other hydraulic fluids near the -32°F to 700°F.

For more information about Versilube F-30 and other G-E silicone fluids, send the coupon below.



Write for more information.

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Series 6100, Silicone Pressure Dose:
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RYAN HAS YEARS OF EXPERIENCE IN MISSILE DESIGN, GUIDANCE, PROPULSION

Modern missiles have not only changed the concepts of global strategy—but also the concepts of basic, speed and power. The instants that consumption, speed, short range and targets of these man-made missiles have made manufacturing methods obsolete. Their imperfections can cause a missile to run amok through violent, unstable combustion or wildly erratic maneuvers. Ryan is skilled in meeting the demanding performance needs of missile fabrication because Ryan has years of experience in designing, guiding and powering missiles.

DESIGN—Complete development of the Pegasus Jet cruise missile—solid rocket and booster stages, quarry penetrators, and dual warheads. The Pegasus is in volume production for use by the Air Force, Navy and

R&D. Ryan has also carried out extensive research on air launched vehicles and is engaged on a new project for an advanced type nuclear weapon delivery system.

GUIDANCE—Development of advanced navigation radar systems for supersonic cruise guidance, IAHAV (Ryan Attitude Navigation), Doppler systems, and ground speed indicators and leveling devices for helicopters, transports and VTOOL aircraft. Ryan is a pioneer in continuous wave radar techniques.

PROPULSION—Manufacture of powerful liquid rocket motors for surface-to-surface missile boost combustion chambers for ground to air missiles and unique high temperature components used by turbine-powered missiles.

RYAN BUILDS ONE-HUNDREDTH BOEING JET TANKER AFT FUSELAGE

Boeing's aft fuselage sections for Boeing KC-135 jet tankers are now rolling off the Ryan production line at the rate of 18 a month.

Production of the giant airframe structures is well past the 100 mark and ahead of schedule.

Ryan and Boeing have been in pro-

duction partnership for more than 10 years. Ryan also builds R&D fuselage sections and including pods, external wing fuel tanks and other components for the KC-135's predecessor, the post-war-era KC-97. The KC-97 production line met "on schedule" delivered for seven years.



PACKAGED POWER FOR DOUGLAS DC-8s

Complete jet engine pods and supporting wing pylons for the new Douglas DC-8 Jetliners are now entering full production at Ryan. Ryan has been a major producer of equipment for military and commercial power plants since 1958.

VERTI-JETS® CAN GIVE U.S. THE ADVANTAGE IN AIR POWER

Unlike conventional jets, Ryan's Vertijet is not dependent on vulnerable runways and air bases. It can be widely dispersed in rough terrain or forests, or underground "bunkers."

This revolutionary craft takes off and lands straight up and down on jet thrust. Combat Vertijets will be more maneuverable and faster than conventional jet fighter-bombers, more mobile and accurate than ground-to-air missiles.

"Such vertical take-off planes give us a decided advantage never before realized," says a top expert on air power. "...as revolutionary a change in tactics and strategy as the jet engine itself."



RYAN BUILDS BETTER

AIRCRAFT POWER PLANTS ELECTRONICS
Ryan Aeronautical Company, San Diego, Calif.

effectuate® the most complex systems

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The human factor becomes proportionately more critical as the operation of modern weapons and industrial control systems becomes more complex.

"Most items' military personnel responsible for operating multi-million dollar defense equipment must be brought to the highest degree of readiness in the shortest possible time. This "Man-Machine" link is crucial to our armed forces — and to be prepared we must be in a position to Effectively Anticipate" the complex systems being designed and delivered.

These ERCO "Human Engineering" training devices are designed to simulate, quickly, automatically, and effectively bring about proficiency in operation at all levels of experience. With our outstanding contribution in the field of simulation in background we are meeting new training requirements as they arise — providing sound, realistic training devices to government and industry.

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AMERICAN FILM PLATE
AMERICAN FILM PLATE



WHO'S WHERE

In the Front Office

Ronald Dostromski succeeds Byron F. Shantz as manager of the broad channel Three World Areas, Inc. Mr. Shantz is now managing director of La Salle, the Netherlands office.

Philip S. Fogg assumes the presidency and chairman of board chairman Comptel Electronics Corp., Pasadena, Calif. Philip S. Cobrin, vice senior vice president, succeeds Mr. Fogg. Also Kenneth W. Tetzlaff, vice president in charge of Mission division, and Frank M. Jansen, vice president/vice treasurer.

John W. Casper, III, a vice president, Blue Chip Internat., Inc., Milwaukee, Del.

Honors and Elections

Dr. Joseph C. Pritch, one of the founders of Capital Chemical Corp. and now a consultant to the company, will receive the 1970 Charles Goettsche Medal, the highest honor in organic chemistry, at the annual meeting of the American Chemical Society in September.

Capt. Ernest R. Hall, USAF, ret., a vice-president of Kestrel Manufacturing, Inc., has been elected president of the Defense Industries Assn., Washington, D.C. Mr. Hall succeeds Dr. W. G. Barnes, former vice-president of General Electric.

Changes

Alfred E. Breuer, manager of flight electronic systems, Avco Avionics Systems, has been elected chief engineer.

W. G. Schatz, chief engineer, Defense Science Hydrogen Division, Nielsen Inc., Denver, Colo.

William M. Akland, chief engineer, Hamilton Standard division of United Aircraft Corp., has joined Loral Corp., M. I. Morris interests. William H. Shaw, current assistant West Coast representative (Los Angeles) for Houston Standard announced his appointment United Aircraft Service Corp.

Stephen J. Vojcik, manager Northeast Sales, operations, Strategic Defense Systems, New England Electric Products, Inc., Waltham, Mass.

Robert A. Mengi, manager, Core Systems Division, Computer Liquid Networks Co., Denver, Colo.

L. R. Swift, special assistant to the manager procurement and procurement Assessment Division, McDonnell Douglas Aerospace Co., Minneapolis, Minn. Ed Land succeeds Mr. Swift as director of procurement.

Dr. George M. Donner has joined the nuclear electronics department of Hughes Aircraft Co., Culver City, Calif.

C. E. Wilcock, director of sales and engineering, Federal Electric Division, General System Corp., Worcester, Mass.

James J. Brown, general manager, Avco International Space Division, Governmental Division, Corp., Springfield, Conn.

Edward J. Foulkes, engineering manager in the president's And Amherst division of Cleveland Passavant Industrial Corp., Cleveland, Ohio.

Robert P. Thompson, assistant chief engineer, American Cloudless, Calif.

INDUSTRY OBSERVER

►Avco reportedly will try to license early warheads without nuclear bursts using explosive explosive forces, possibly from a nuclear bomb to drive penetrators, causing satellite to a duct in the earth which serves as a guidance "gas line." Progress may be related to similar Advanced Research Projects Agency project designated "beam-powered rocket." Avco is aiming that future satellite weapon equipment will afford 15,000Gs for 5 milliseconds, the same as its shock requirements for electronic proximity fuses used in field projectiles.

►Life science studies are being pushed in Air Research and Development Command's biostabilization project, designated Micro-Space Society, even though the program has not yet been funded, indicating AFRC's intention to meet proposed schedules.

►Russia's Interplanetary glider project similar to USAF's Dyna-Soar program already has entered the development stage. Effort is based upon the early work of German expert Eugen Sänger which has been expanded by Soviet scientists.

►Rothman's Sparrow III side-booster guided missile developed for Navy's Bureau of Aeronautics has a pointed conical nose cone measuring about 22 in. in length and about 4 in. in diameter at the base. Candidates applying criteria for canards would have some application include Gladding, McRea & Co. and Coming Glass Works.

►Air Force has requested \$11 million for initiation of research and development on a discounted rate fighter for theater tactical operations in the fiscal 1970 budget. It previously had \$2.2 million for this fighter in the fiscal 1968 budget.

►Initial development on a single pump and a single gas generator for the Atlas ICBM engine has been completed. Atlas now uses a booster with two oxidizers and one booster engine, and each has its own propellant pump and own generator.

►U.S. officials soon assure in February that the Soviets intended to place a satellite weighing more than 3,000 lb. (Sputnik III) into orbit to Mir.

►First Jupiter intermediate range ballistic missile squadron to be used by USAF will partially follow Army's plan, but interceptors will have more boosters and reaction time will be reduced. Air Force did not make any changes in the first unit because it would have delayed introduction of the weapon.

►Cost of an IRBM squadron plan has been built from scratch will cost Air Force an estimated \$70 million. Once a base is established, cost of an additional squadron plan plus weapons resupply and equipment will be an estimated \$45 million.

►Approximately half of the first 603 B-52s ordered by Air Force have been delivered to operational units. Initial quantities of the modified improved B-52G will reach the inventory late this year.

►Rutan has built a dual-control trainer version of its two-place X-15 aircraft helicopter. Designation is USA-15.

►Ultimate throwaway cost of Convair's intercontinental ballistic missile is expected to be \$4.6 million. Unit cost of the Thor IRBM in production is expected to be \$755,000.

►North is preparing a follow-on to the Vanguard satellite program incorporating Aerojet's Jupiter upper to the upper two stages of Vanguard. Payload weight probably would include vehicles of 10 lb. to 100 lb.

►General Electric is working with its subcontractor, Learjet, on design of its 135-seat jetliner for flights of up to Mach 6.



THE ARMY'S H-23D RAVEN: INVESTMENT IN TOMORROW

Over 20 major improvements distinguish the H-23D as one of today's most advanced helicopters. But several features in particular verify its unmatched growth potential, which is a prime requisite for the evolution of any helicopter investment.

Basic ruggedness: The H-23D has the highest flight and landing load safety factors of any two or three place helicopter flying today.

Component life: The H-23D's 330 horsepower is available full-time, without restrictions limiting its recommended service life. In fact, all existing components are designed to accept considerably greater horsepower and to utilize an overload period beginning at 1000 hours.

Potential Versatility: More power, more cabin space - further qualify the H-23D as a evolutionary helicopter, linking up to basic Army concepts: more utility from fewer units.

The H-23D is now prepared to receive a new 305 horsepower engine, without further major modifications. The resulting UH-12E (prototype now flying) has already demonstrated a performance which will capture new missions beyond those previously conceived for this helicopter class.



HILLER HELICOPTERS
FIND ALTO, CALIFORNIA



Washington Roundup

Rearorganization Fight

President Eisenhowers has reversed his position and decided to fight it out with the House Armed Services Committee, as Rep. Carl Vinson (D-Ga.) and the congressional members of the Defense Department. The measure is aimed by House action.

A few weeks ago, the President recommended the compromise legislation unanimously approved by the House group, 32 to 31, rising with two objections to it in wild language (AW May 26, p. 25).

But in the last few days before approach, the President issued a strong blast against provision of the measure at variance with his own plan which he declared, would "contribute to espionage, disorder and separation with the Defense Department." This continues to impede Congressional approval of wanted legislation, administrative delays and intrusiveness continue. The process would:

- Require the Secretary of Defense to administer the department through the three service secretaries. The President declared, "such a provision on my original bill was in error. I regret much. He said it would give the added risk of leakage to financial delays, diplomatic trouble,
- Require congressional review of any change or addition to major executive functions. This, the President protested, affects one matter, and will hold up defense appropriations for some months and perhaps block them altogether.

• Authorize the services secretaries and chiefs of staff to present their individual views to Congress after first discussing the status of Defense. The President challenged that this "wastes congressional time to the President and Secretaries of Defense," endorses the idea of delaying and blocking of defense modernization, suggests that Congress "lives for obstruction and interference."

House Republicans, led by Joseph Martin (R-Mass.) and Rep. Clarence Cannon (D-N.C.), chairman of House Appropriations Committee, are backing the President.

Soviet 'Fishing'

Holloway Soren, fishing ships, rating at nuclear reactivation. Flying within 150 miles off Nova Scotia are reported of reactivating naval and anti-submarine patrols undergoing test flights of Boston less than 100 miles north. That such number of ships within range and that a departing ship is always placed suggests that Soviet ships are seeking to learn characteristics of new radar for possible electronic countermeasures.

No Fixed Profits

Defense Department has issued House Appropriations Committee it will have a number of cost proposals to apply to military contracts by the end of the year. On profits, the Defense Department is firmly advocating some congressional measure for a fixed profit limitation. Peter McGuire, Assistant Secretary of Defense for Supply and Logistics, explained to the committee:

"We find that policy guidance in the field of profit allocation must be stated in order to prevent the factor affecting a reasonable rate of profit run in each contract. Within the aircraft industry, for instance, there are wide variations in the factors which determine a com-

sensate rate of profit such as the extent of government assistance, or the risks assumed by these contractors and the contractors with whom contractors are performing. Accordingly, we do not feel that it would appear appropriate to establish an exact profit margin applicable to all or other industries. We Congress has recognized in the Negotiations Act the factors which determine a reasonable rate of profit."

Communications Compromise?

Compromise which might enable defense to operate Doppler navigation at \$380 mil for the life of the equipment or some other reasonable period, provided that are willing to wait. Interimly, from military立es, radios may now out of an emergency situation in which Defense Department and Federal Communications Commission representatives of last week's Armed Forces Communications and Electronics Area conference, indicated participation in the frequency allocation conflict, where therefrom to block early service use of Doppler radio (AW May 26, p. 35), half had found working man is attempt to work out details.

Nevera Halted

An F-106 has initial development of Nevera long-range navigation system and will use self-contained or airborne Doppler and/or inertial systems for its conduct as well. An F-106 plans to perform long-range ground-based navigation system development for tactical use. Lt. Col. D. J. Friend told the Armed Forces Communications and Electronics Area conference friend, deputy chief, No. 3 Air Force USAF headquarters, flatly denied reports that Doppler auto-navigation might replace Nevera for short-range navigation, saying that Nevera could remain USAF's primary short-range system for at least the next decade.

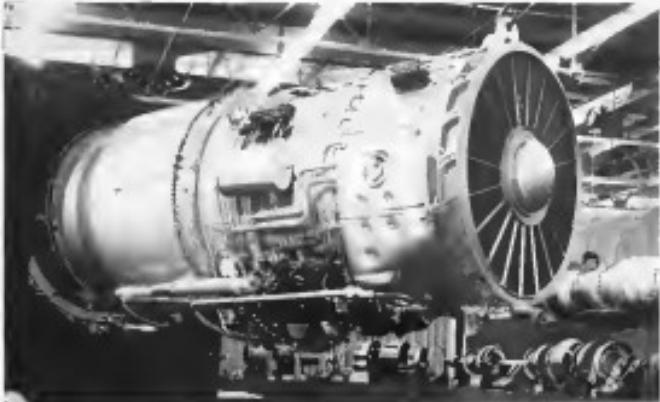
Durfee Warning

Civil Aviation Board Chairman James Durfee last week warned against the abandonment of existing air traffic controllers in favor of a "short new system" which would, moreover, produce safety in the air. However, Durfee apparently was not voicing opposition to the proposed Federal Aviation Agency (see page 26). He was urging that no hasty program attained soon for not be dropped because of high hopes for a complete program that will solve problems overnight.

Missed Opportunity

Nearly all members of the House voted an opportunity last week to participate in an event that can really bring the whole lot of life. Less than 40 representatives in a row behind who the House voted to create the National Aerospace and Space Administration to lead the U.S. in the exploitation of outer space. Although little further was attached to the proposal, Rep.孙纳·凯特(R-N.Y.), a member of the House Space Committee and "Viking the long time I am convinced that that bill will be the most significant legislation to come out of the current Congress—indeed, to come from any Congress. It has the solid leadership stamped all over it."

—Washington staff



PRATT & WHITNEY J58 Mach 3 turboprop at least one and a half times larger than Pratt & Whitney's JT3D engines.

J58 Reflects Navy Development Changes

By J. S. Bots, Jr.

West Palm Beach, Fla.—Changes in Navy philosophy of jet engine development is being reflected in Pratt & Whitney's J58 Mach 3 turboprop now coming off the test stand.

New policy calls for a sharp increase in the number of long-haul flights before an engine completes its 150-hour test and is accepted for production.

The move reflects Navy experience showing that the ultimate cost and operational return of an engine in fleet use is about a dozen fractions of the cost of testing performed during the development period.

In the past as few as eight repre-

sentative engine have been authorized for a complete development program, lasting 100 hours less and often resulting in long delays for repair and rebuilding. Under the new policy, Pratt & Whitney will build approval models 30 test J58s in the experimental stage of its new Hirsch facility, which is approximately one-third larger than the previous small facility. This class, part of a \$30 million Pratt & Whitney investment, contains \$15 million worth of the largest and most modern machinery tools required by the Navy.

Rentle Test Facilities

Testing facilities at the Florida site now consist of four open air jet engine test cells located a few miles from the

engineering offices and shop in that they do not require consideration of instrumentation of these cells and other test areas have been started with a \$10 million contribution from the Air Force.

Altitude testing of the J58 will be conducted at Pratt & Whitney's Wall挂式 Laboratories at West Hartford, Conn., and at government facilities.

The J58 joins the U.S. Air Force's program and two turbines in the Mach 3 class. The other engine is General Electric's J93 which already has been designated as the powerplant for two Mach 3 planes North American's aircraft for the Air Force—the supersonic B-70 bomber and the twin-engine F-103 long-range interceptor.

Air Force test engineers for a Mach 3 aircraft to be fitted with the J58. Recent statements by Navy officials indicate that they believe that the engine development work will be conducted first for the aircraft. Therefore, an appropriate altitude and its exact nature would be determined after the acceptance capabilities become much more definite.

Apparent reason for the approach is the severe difficulties the naval aircraft program suffered several years ago when the J57 engine failed to meet its original specifications. A copy portion of the Navy's new strength design



OFFICES, engineering section are in new site of building; experimental shop is in old.



CURTAIN AT the rear of the J58 (right) encloses the structures. Pratt & Whitney will build 30 test J58s in Florida.

at the time had been published on three specifications.

Some tasks are being expanded, with both the J58 and J93 Project use of the cleaned fuel and its ultimate availability and attractiveness to cost are apparently still some question.

To achieve the most efficient or base design for a given mission, however, the decision to build either chemical or petroleum fuel or some derivative combination of the two must be made at the very beginning of the design.

The Pratt & Whitney facility in Florida is situated on a 10,000-acre tract which is only 10 miles from the populated area and about 15 miles from Palm Beach. Selection of this site on the edge of the Everglades for new engine development work was based on many factors but the primary considerations included obtaining extensive services with close proximity to a desirable living area to attract personnel.

Location Required

Holders were required to mention good reasons related while developing very large and very noisy rocket engines and other high speed projectiles that Pratt & Whitney has long been known to be working on. Consideration of a portion of the foreign area of the production of the facility when Lt. Gen. Clarence S. Jones, USAF, deputy chief of staff of material, visited that Pratt & Whitney's

meny involved work with hydrogen fuel (AW June 2, p. 28).

Joint investment of \$30 million in company-owned, as the Florida plant follows a well-established United Air craft policy of requiring its own expandable facilities to speed development work without having to rent an outside laboratories. During the past 10 years, the corporation has spent more than \$300 million in construction of new facilities.



OPEN-AIR jet engine test beds are located four miles from offices and experimental shops.

Mahon, Symington Hit New Complacency

By Katherine Johnson

Washington—Two top Capitol Hill lawmakers on military matters attacked the defense program under last October's launching of Sparrow II as an arms越ceremony last week in the House and Senate.

* Rep. George Mahon (D-Tex.), chairman of the House Appropriations Subcommittee on the Armed Services, said that "in a net preparation applied to defense effort, we will perhaps be spending less in fiscal 1959 than in 1958."

Mahon said that the \$10.1 billion fiscal 1959 defense budget does not represent a cold spending splash for the sustainably.

"It is set on evenly

outward approach by our defense problems, but it is not a net

increase," he told reporters.

He listed three highlights:

\$56 million for the North American

B-72 bomber scheduled to succeed the Boeing B-52.

\$393 million for the experimental

balloon missile program—Atlas, Titan

and Minuteman.

\$783 million for the Convair B-58

bomber scheduled at the fallow air to the Boeing B-47.

\$1.3 billion for Navy's Polaris fleet

ballistic missile program. Combined with the previous program, this will provide funds for a total of two Polaris weapons.

\$3.7 billion for research and develop-

ment, a decrease of \$57 million over

fiscal 1958 for maintenance and

\$1.8 billion for programs to put man

on space.

\$50 million for the nuclear-powered

aircraft program. Mahon said: "We will probably be beaten to the draw in this field because our government has elected to undertake to build a sophisticated and relatively significant atomic aircraft earlier than its task ahead with space exploration." He added: "In the area which would be little concerned and rapidly important."

Mahon defended the Appropriations Committee's action in eliminating \$33 million for long-haul flight for a second nuclear-powered strategic aircraft.

These are the recommendations of

Senate Appropriations Chairman

John J. Sparkman's committee on the

program, which has been

criticized as being "overly conservative" and "unnecessary."

Although the \$33.3 million in cut-

item was carried in the House bill,

the Senate version of the bill

which was introduced in the Senate

last January, with Mahon's com-

mendations on the progress that has been made to adjust them.

* Moderate, not strengthen. SAC

has been on an acceleration plan

of recent production programs,

Symington declared. "A low rate long-

range jet bombers and bombers were

scheduled... but now additional

SAC says—and that wing is not

planned to be operational for three years."

* Accelerate the disposal of SAC bases. "So far as I can imagine, SAC aircraft, defense missile facilities and other important military equipment are in place now and actually being maintained over more confined areas."

* Increased effort in development of an anti-missile missile system. "The organization is faced with this problem. It is now worked out and current divisions of functions between the services can help move increased waste and delay."

Warning and instructions issued largely in the Air Force but the launching function must be coordinated. Both services must constantly reassess their efforts to carry out this vital mission—and that should appear to be one of the chief tensions in the entire program is characterized by disorganization and little sense of urgency."

* Improve early warning systems. Construction of the distant early warning base against swarmed bombers "is proceeding slowly," Symington told the Senate.

"We largely, to advantage, established expenditure ceilings."

* Provide adequate swift fuel for ground troops. In a heated test, Symington said: "Apparently we must hope for some miracle to be able to transport troops where needed."

* Establish a production schedule of Atlas. Then, Jupiter and accelerate development of Titan. There has been no acceleration of the Atlas. That is despite progress, Symington pointed out. Lack of a sense of urgency continues to dominate the long-range missile program."

* Reduce lead-time in weapon devl opment by reducing the decision time and simplifying procurement procedures. This, Symington complained, is still "too slow."

* Increase research and development programs. By long term funding and no proved administration. Although research control through the Advanced Projects Research Agency "should give better direction," Symington said, the continuation of expenditure ceilings plus the usual appropriation requests for research and development do not lend an impression that that really important part of our national defense program is really being accelerated."

* Increased effort in development of manned missiles. There has been progress with the uncrewed-manned orbital X-15 and programs like the modified research for space flight, Symington said, but "most action is also handicapped by available funds."

The results of this attitude of complacency is the great amount of fuel consumed during combat by the nuclear engine in comparison with the F104's turbojet with afterburner.

Advantages of the afterburner mode would be greater rate of climb and a more rapid acceleration from cruise to combat speed. According to NACA, a supersonic aircraft which achieves the first Mach number of the F104 and the F103, they both are capable of more than Mach 3, and it is possible that a more advanced engine

F103 is powered by a Pratt & Whitney JT3 engine developing about 17,000 lb thrust without afterburner and around 26,000 lb with afterburner. Symington also is designing around use of a small rocket engine or several small jet engines.

This rocket engine seems to be the key to the Navy's eventual choice between the F104 and the F103 for volume production and transonic fighter fleet. The fact that both aircraft are still in the competition would seem to indicate that the present difference between them is the powerplant arrangement that neither fighter has had more than its share of stability or drag trouble and that they both have about the same percentage of total weight devoted to structure.

Rocket power would give the Crusader III a much greater striking distance than the F104, and, to be of value, this altitude would have to be maintained for several minutes, probably at least four as usually specified for analysis studies.



CHANCE VOUGHT F8U-3, Mach 2, all-weather interceptor is shown, without its nuclear engine. Primary powerplant is the Pratt & Whitney JT3 turboprop of about 17,000 lb thrust. One engine is solid and modified from propeller type. Two variable fans are added to the present. Krebsized canards wing end provide a location of the missile launcher.

F8U-3 Mach 2 Fighter Makes First Flight

Edwards AFB, Calif.—Chance Vought Aircraft's F8U-3 Crusader III, extruded in Navy's Mach 2, all-weather fighter competition with McDonald's F4H, made its first flight last week. (See p. 41 for F4H details.)

Crusader III is slightly larger than its predecessors, the F8U-1 and 2, but the wing and tailfins were generally scaled up with the propellers and landing gear more or unchanged on the new aircraft. Major alterations required in increasing the Crusader's speed made the full Mach number was the incorporation of a smaller Fiero true swept sonic inlet with a swept forward lip. The addition of two large round fairings on the wingshank fuselage nose and a nose ram-air scoop.

F103 is powered by a Pratt & Whitney JT3 engine developing about 17,000 lb thrust without afterburner and around 26,000 lb with afterburner. Symington also is designing around use of a small rocket engine or several small jet engines.

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ing. Vertical feet are raised at the same time the flaps are lowered so that the tail will clear the ground during landing. Double sweep wings are used to ease the sting.

A primary feature of the F104 is, although it was not used during the first flight, is the automatic release of a large quantity of flight refuel. These large drogue tanks which attach to the first wings of the F104 and the F103, they both are capable of more than Mach 3, and it is possible that a more advanced engine

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New Micro-Module Program Outlined by Army and RCA

By Philip J. Klass

Washington—Army's new Micro-Module program, which could have major impact on both electronic component and equipment manufacturers, was officially outlined here last week before some 600 industry representatives by the Sigma Corps, West Radio Corp. of America, RCA, and several of the program's contractors.

Mr. Klass and Mrs. Klass are now returning to Army to report that the participants will support the new Micro-Module program. Army officials predict that joint service support will be forthcoming.

Six Reductions

New Micro-Module construction techniques for fabricating individual components and joining them into functional current leads promise of 10 fold reduction in size, weight of subsystems, electronic equipment (AW June 2, p. 21, 24, 45), and, with additional processing, a considerable gain in reliability, according to Dr. Werner Menge, Director, Micro-Modules, who will be among the field experts at afternoon's meeting.

Micro-Module consists of a suitable interwoven mesh of 0.3 in. sq. ceramic wafers called elements, in which one or more components have been assembled. Individual ceramic wafers, as well as the complete module, have some resemblance to earlier Navy Project Tinkerer units, but are considerably smaller in size.

Micro-Module design is based upon using transistor and other silicon electronic active elements rather than transistors and resistors. The use of the latest Micro-Module technology, in low-power level application such as man-communications, computers, instrumentation, and control.

Greatest impact at first will be felt by electronic component manufacturers who are being asked to abandon long used basic tactics to design components to fit standard S-1 pin dimensions of Micro-Module clients.

For more precise components such as resistors, certain sizes of capacitors and transistors there appear to be no major obstacles. Other types of non-potentiometer, potentiometers, relays, etc., will be more difficult. RCA plans to stimulate relay suppliers to assist in innovation toward meeting the program's needs.

Although existing component techniques will be used initially to speed the program, an RCA official relinquished that the ultimate goal is to use

entirely different types of semiconductors devices which can perform complete circuit functions (AW June 3, p. 46).

RCA will subcontract most of the component development work to established firms with required competence. Companies willing to be so associated were advised to write to G. W. Levy, Manager, Purchased Equipment, RCA Defense Electronics, Rochester, California, N. Y.

Programs also will require the development of a set of bills of lading that are dimensionally compatible with new Micro-Module. Barriers are to be removed in voltage of 151, with bills for 16, 1, 6, 9, and 12 v.

Total design goal is for components capable of operating in ambient ranges from -55° to +125°C, with an upper limit to 125°C, eventually to 200°C.

ICA Plans

During the next two years, ICA expects to develop a limited family of Micro-Module component packages to enable the necessary to follow-up experiments on capable of performing MP-II, and under-subject functions plus certain basic computer circuits. In 1962 RCA expects to deliver complete proto-type experiments constructed almost entirely from the new Micro-Module.

Other equipment manufacturers will be able to buy components as well as to fabricate widespread use.

from firms like supplier, such as this new positive conventional component and combine them into their own circuit configuration, according to present plans.

An engineer of Raytheon Electronic system component assembly and test department has now proposed one of the component elements, known as Micro-Molecules, as a result of previous company research along similar lines.

While expressing confidence that the required components could be developed by industry, he maintained that component manufacturers are "being asked to intent all components over again as only face views and come up with smaller, for more reliable designs than they have been able to develop during the past 10 years."

Inducement Funds

The Sigma official stressed that the \$7 million which Army has set aside for the Micro-Module program is too little for a program of this magnitude. He also claimed that incentive inducements that reduction in cost and power consumption increases in output and precision clearly would encourage industry to manufacture Micro-Module.

Reinhardt, in comments from other army procurement personnel, suggested a \$100,000 set aside incentive. One general observer privately speculated that the Micro-Module program may well be a huge undertaking from this viewpoint in the Army and RCA and that, unless the program quickly receives almost prime support and 10 to 20 times more funding to growth accelerate the effort, it may not serve its true purpose of widespread use.



How F-102 Mounts Falcon

Mounting of two different types of Raytheon Falcon missiles is shown on a Convair F-102A GARD-1000 guided missile is mounted at the forward station and the homing-guided GARD-3 is mounted aft. F-102A is shown carrying an Falcon. Apertures in discs allow use of the tubes for mounting to nose fairings 2.75 in. air intake nozzle.

AIRPORT WEEK, June 9, 1966

German Air Industry Promised \$250 Million Licensed Production

SR.53 Crashes

Stavros Rov SR.53 model helicopter powered lighter exploded on takeoff and crashed last week at Farnborough, England, killing the pilot, Mr. John R. Rov, and his co-pilot, Mr. John C. Rov, who was killed. The aircraft was powered by a de Havilland Spectre under engine was heavier and had high tail position as compared and an Armstrong Siddeley Viper turboprop.

not do the job alone or even in operation with just the United States. Therefore in this subject has already been initiated with the French-Holland-Carrier aircraft project was selected for the beginning of this year.

Stavros said that for the period 1965-68, two thirds to three quarters of German aircraft would consist of trained planes.

Little Military Value Predicted for Space

Touting of space research as a defense priority to unmet technical needs facing lack of public support for a program based on purely scientific motives was endorsed by Dr. Alton Webb of California Institute of Technology's Jet Propulsion Laboratory in a speech to a recent Los Angeles Air Pollution District.

Webb said that whereas applications of the space research project are uncertain and probably limited. He predicted that when the truth comes to light public disillusionment will cause morale erosion and moral reversal.

He said that the bulk research is passed to the public, causing a vicious cycle effect after the competitor will in scientific direction which he feels the space program needs. However, the future of the program can still be jeopardized if the U.S. taxpayer is scared into paying more and more money in illegal and unnecessary military ventures, he added.

VTOL Rotodyne Makes Transitions

White Waltham, England-Tony Rotodyne VTOL transport demonstrated transitions last week from hover-coupling and landing in regions without loss of altitude and little change of altitude.

Nose gear can lift but not disengage in the helicopter regime, making rotor tip jets for propulsion. Nose supports will be lifted by the jet boost to reduce the main fairing, however. In flight, the nose of the two Napier Siddeley turboprop engines is less than that of a Vickers Viscount.

X-15 Instruments

Washington—Several initial flight instruments developed by Stinson Engineering Co. will be used by pilot of Air Force X-15 hypersonic aircraft vehicle for guidance and determination of air temperature in re-entering dense atmosphere from altitudes beyond 100 miles.

North American Aviation's X-15 will carry Stinson-developed flight instruments which display vehicle attitude, velocity, vertical rate and altitude, of obtained from inertial sensors. Computerized programs monitor attitude and display altitude and enable one click because of new sensor conditions. Stinson also gives pilot continuous indication of jet position and deviation from pre-set flight course.

Burst of the new system is a result through stabilized platform. This form has liquid-type servo-sensing system and a small computer. System has been designed to withstand accelerations above 10-G. Stinson's system is being tested with the aircraft in National Advisory Committee for Aeronautics for preliminary flight tests in an F-101 flying test bed.

AIRPORT WEEK, June 9, 1966

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Civil Space Agency Bill Passes House

By Fred Esham

Washington—Legislation to create a powerful national space agency under civilian control passed through the House last week and went to the Senate without a dissenting vote.

The measure introduced in Rep. John W. McCormack (D-Mass.) would establish a National Aerospace and Space Administration with the National Aeronautics and Space Act of 1958 to National Aeronautics and Astronautics Act of 1959.

Albert Resumes

McCormack, chairman of the House Space Committee, offered the motion to revise the version establishing the power of the administrator over the space program.

The action took place after Rep. Carl Albert (D-Ga.) introduced a resolution calling for a 21-man Committee on Science and Astronautics to be composed of members of all other House Committees interested in space projects.

McCormack and the House resolution would create a committee with a broader base, then that of the joint committee and that it would be necessary to postpone the process for a year or two.

He hoped action on the Albert resolution would be taken before the end of the session, but that so far the measure has not been introduced.

An amendment to create higher, more equitable salaries for working scientists and engineers was offered by Rep. B. F. Steagall (D-Ala.). It was

referred to the House Space Committee.

He said the present law authorizes the administrator of the space agency to pay slightly higher compensation to a limited number of personnel than is now permitted by the Classification Act, but that there is no comparable provision for the starting salaries of recent scientific and engineering graduates.

Steagall explained that the administrator would inform the administrator, if necessary, to his personnel of the size of a GS-7 rating rather than the word GS-7. He said a GS-7 would be able to start at a salary of \$4,980 while a GS-7's worth receive \$4,000.

Major Provisions

In addition to the amendments made on the floor, major provisions of the bill as passed by the House include the following:

- Activities of classified in outer space shall be devoted to peaceful purposes and the general welfare with objective safeguards for the common defense and security of the U.S.

- That such activities shall be directed by an entity which the chief of the Defense Department "trusts" in such activities as possibly associated with weapons systems, unless open to the defense of the U.S.

- That the agency shall be responsible for the American Astronautics Committee and other agencies involved in such space activities as associated with military research and development.

- That management of NASA be vested in an administrator and deputy, whose authority appointed by the President and confirmed by the Senate.

- That a House aerospace committee be created, of which nine members be designated from appropriate congressional delegations or agencies, including at least three from the Defense Department, who, in turn, will be chosen from the fields of science, engineering, technology, public policy, etc.

- Creation of a Military Launch Committee and an Atomic Package Launch Committee.

- Creation of a Division of Military Application and a Division of Nuclear Application in addition to others that may be determined necessary.

- That information obtained or developed by the administrator shall be made available for public inspection, except classified information necessary to protect national security, or that authorized or required by law.

- That all functions, real and personal property, personnel, funds and assets

of NASA be transferred to the space agency.

• That funds appropriated for administration and operation of the agency would expand on a continuing basis, also, funds appropriated for construction of facilities, or for research and development activities shall accrue until the total is expended.

The cost cut of an effective space program was estimated by the administration to range from \$100 million to \$700 million a year. The House Space Committee, however, estimated it would take about \$500 million annually for the first several years and perhaps a billion dollars a year thereafter.

In trying passage of the bill, McCormack and other effort has been made in the legislation to define the functions and powers of the new agency in order to prevent possible conflict and waste. In preparation of the bill, House India said that the program will be reorganized and strengthened.

USAF Pressure Suit Tried in Space Cabin

San Antonio—An unusual test project has begun in a pressure suit at the Air Force School of Aviation Medicine's space cabin simulator found the equipment extremely uncomfortable.

Staff Sergeant Marion L. Audit, 36, and widow for two days, was the test subject in which Airman First Class Donald G. Parrett acted as test director. From the first, the pressure suit was so uncomfortable that could be provided, Audit said in the pressure suit and had a longer flight.

Significance of this latest experiment lies in the fact that suit will be used in deep breaths on low pressure suit when he returns into space and that it is important to feel good in order to remain in it over long periods. Audit said that the first time in the

Swiss Drop P.16

Geneva-based government has established a development and production unit for Breguet P.16 glider attack aircraft following its acquisition of the crash of the dual prototype since late October. It was the second P.16 to make its final descent (AW Nov. 31, p. 28).

Official reasons for the cancellation of that redesign of the isolated review world didn't determine.

Observers believe this provided a sufficient excuse for the Swiss to drop in uninvited without prior notice to Japanese ports to disengage in Japan for field operations and training.

Japanese sources say a brief meeting with Japanese representatives in the Naha Airport category has probably again,

AERONAUTICS WEEK, June 9, 1958



Mk.8 Javelin Equipped with Afterburners

Gloster Mk.8 Javelins, British all-weather fighters will enter Royal Air Force service later this year, replacing previous types. An modification of the Mk.8 is changes by providing afterburner nozzle as in the Armstrong Siddeley Sapphire engine. Like the Mk.7, the Mk.8 is equipped to carry de Havilland Firestreak nuclear weapon or to carry missiles. (AW March 31, p. 77) Aircraft is taking of from runway field at Brooklands, near London, generation just ahead of others.

Boeing to Receive Hound Dog Mockup

Douglas, Calif.—North American Aviation's Missile Development Division will be the test model for GAM-95 Hound Dog missile under contract to Douglas. The value is \$10 million.

Missile will resemble resembling the missile's main configuration, and will have one motor of propellant. It can be used for gathering intelligence, low while mounted on modified S-31 aircraft's fuselage, plant, or it may be sent to Wichita for use with the F-86-SG, the aircraft for which it was designed.

Missile will be carried on a special pulse containing monitoring and launching equipment.

Missile procurement will be a Project 41. Wichita Hound Dog will be used to conduct a series of tests and to determine the performance of the missile. Missiles will be used to provide simulated target for ground-to-air missiles.

Wichita will be used to provide simulated target for ground-to-air missiles.

Japanese Plant to Test Swiss Rocket Battery

Genoa-Centocelle, Italy—The Swiss anti-aircraft rocket battery, a self-propelled homopolar gun, is being developed in the Japanese ports to disengage in Japan for field operations and training.

Japanese sources say a brief meeting with Japanese representatives in the Naha Airport category has probably again,



External Rack on DB-47 Holds Rascal

Rack mounted, an external side of Boeing DB-47 bombers feature holding bubble Rascal. Rascal is a four-camera television camera system modified to carry the GAM-48B missile to SAC (AW April 14, p. 47).

AIR TRANSPORT



Douglas DC-8 on first flight. Aircraft weighed 170,000 lb, and total of about 3,300 lb was at speed of 430 ft.

DC-8 Moves Into Flight Test Program

Los Angeles, Calif.—Douglas DC-8 moved into the flight test phase of its development with routine take-off on the McMurdo Do. first flight. The first DC-8 underwent two series of test flights, one ground and one in test cells at the Radio Control facility preceding the mark over Santa Barbara and landing at Edwards AFB.

Plane will operate exclusively from Edwards and about 10 hr have been logged, after which it was taken West Coast or land at other airports during flight tests. Eight test engineers will be assigned to the test program and 25 will have been completed by the time the test program is ended.

Plane will be delivered before 11:00 a.m. on December 10th to the first test flight, which will be carried out by Captain Bill Lamm, delivery pilot, who flew the aircraft from the Douglas plant in Long Beach, Calif., to Edwards. Delivery service should start by the second week of December. Delivery service should start about 90 days after the first flight.

The DC-8 is rated at a 3,300 lb. ton of weight at 430 ft. The engine weight with 190,000 lb. at 430 ft. off 1,000 lb. more than maximum landing weight. Four JT4D-5 (JT5) ratings generated during ground tests as they developed a total of 30,000 lb. thrust with static operation at idle.

Otherwise near the same, reported originally last month, load from the engines which were equipped with an experimental multiport sound suppressor. Most objectionable noise at

close range was suspension whine but some slight vibration from the engine nacelle.

Calibration day, part-and-systems supervisor referred for reference on Tuesday.

Tests on first flight were carried out at altitude up to 15,000 ft. The air plane was cleared for ground handling characteristics and hydraulic, electrical and air conditioning systems were tested out. Some of the right side number panels on the test airplane were replaced with rope with padded dashes of the regular passenger control valves.

Total of 138 DC-8 have been ordered to date with a total value of \$700 million. Northwest Airlines is expected to take up and for several major Western U.S. carriers to receive about 5225 aircraft in the DC-8.

First 30 airplanes will include six more and executive models. These different passenger versions and more different customer configurations. Dimensions of the executive and domestic versions are identical, but executive version has been given more attention to styling. In producing additional 26 100 lb. of fuel out in increasing strength of wing and leading gear.

More DC-8s now on order will be powered by the Pratt & Whitney JT8 (JT5) and many customers will be powered by the Rolls-Royce Conway. First engine will fit with the Pratt & Whitney JT8 (JT5). Second

will have the JT6. First JT6-powered DC-8 will be delivered to Pan American World Airways in December, 1968, and the first with Conway will be delivered in February, 1969.

Airplane powered by the JT5 have four separate engine-driven propulsor units with maximum output with four 190 hp each. The units are geared to receive a primary flow at starting, 144 and Consett version do not use water injection.

Western Strike Ends

Los Angeles-Police ended the long Western Air Lines strike by returning to work to end by the company last week. Strike will resume operations in 28 cities on June 10 with 12 flight months to allow incomplete dispersed air transportation.

Since approximately midday of Monday that is stated in the Los Angeles area with most flight originating from there, but days previous who will conclude flights from Los Angeles to San Francisco, Seattle, Minneapolis and Salt Lake City.

In accordance with an agreement signed by company and union representatives, first flight will be operated by pilots with greater seniority. Aircraft will be throughly cleaned prior 180-hour checks and complete flight briefings by supervisor prior to returning to service (AW June 2, p. 32).



Douglas Aircraft Co.'s DC-8 jet transport, shown here on first flight, completed its second flight at Edwards AFB last week. Aircraft was in the air for 2 hr. and 3 min., during which it exceeded envelope of speed and altitude of first flight.



AIRLINE OBSERVER

► Industry controversy over the no-new control plan has been building rather than easing since a compromise agreement was adopted last month by the Air Traffic Conference following American Airlines opposition to the plan [AW Mar. 26, p. 39]. Possibility is now strong that a majority of terminals will refuse any effort to water down either the modernization or maintenance aspects of the new plan. The holdup phase of the plan, although most airlines will be willing to let it sit, probably will drag on in the picture. A sharp upturn is forecast with American negotiating a more flexible plan, while Eastern will lead forces pressuring the plan at its present form.

► Hearings by Civil Aeronautics Board on the Pan Am 747 collision on April 21 may extend beyond the scope of normal accident investigation. CAB is hopeful of taking a deeper look into the relationship of crew to weather information and a report on the case that will detail the overall problem basic to the collision hazard.

► American Midwest Time (GMT) will be standard time for all domestic operations effective June 15. All flight plans will be filed in GMT and all Civil Aeronautics Administration airway and navigation procedures will be conducted with GMT standards. Passenger schedules and published arrival and departure flight times will not be affected. Purpose of the action is to gain a closer integration of international and domestic navigation procedures. Airlines have been preparing for the change ever since last October.

► Aeroflot, Soviet-based airline, is converting all its Ilyushin, twin-engine IL-14P transports to accommodate 24 passengers. "This producing more and more of routes additional revenue annually". The modification, which requires strengthening the lower part of the fuselage, will give the Russian IL-14Ps the same seating capacity as the newer, longer IL-18Vs. East German began rechristening 28-passenger IL-14Ps last year.

► American Airlines has placed an order with Federal Telephone and Radio Co. for Tacan compatible distance measuring equipment (DME) 7.1 to be installed on the carrier's fleet of Boeing 707 jet transports, conforming to airline predictions by Aviation Week [AW Mar. 12, p. 43].

► Presidential Interagency Board completed its hearings in Washington last week on disputes between Eastern Air Lines and Air Line Pilots Assoc. and Flight Engineers International Assoc. Division is the issue which began in New York Feb. 10; it is expected to last a month.

► U.S. Air Force will fight for a cut in its annual contribution to the Inter-American Civil Aviation Organization, although the amount of the reduction is not as great as originally sought. As a result of U.S. pressure, certain types of member assessments will be studied before further adjustments to contributions are made.

► Rate of return of Class A bonds declined to 2.72% for the 12 months ending April 19 from 3.87% for the same period in 1957, according to an estimate by the American Assoc. of Refineries. Net income for the group dropped to \$521.5 million for the first four months of 1958 from \$595.8 million reported for the first four months of 1957.

► Air Conditioning Committee has scheduled an international symposium on "U.S. domestic short distance navigation systems—Vicar and its relatives ship to the international air navigation system." Invitations to aviation officials and agencies in foreign countries are being issued through the State Department. ICAO has selected a special meeting in February to short distance air and their relationship to other elements of the air navigation system.

► Northwest Airlines will defer implementation of its recently passed Chicago-Minneapolis until after Oct. 1. When service begins, the airline will offer first class service with Boeing 720s, coach service with DC-8s, and a combination first-class/coach service with DC-9s.

SHORTLINES

► Civil Aeronautics Administration has published a booklet on regulations and procedures for administration of the labor and wage portions of the Federal Aid Airport Program. The booklet, "Federal Aid Airport Program, Labor Standards and Enforcement," gives data, was prepared for guidance of airport agency sponsors and contractors performing work under the program. Booklet can be obtained without charge from Civil Aeronautics Administration, Washington 25, D. C.

► Eastern Air Lines has taken delivery of its last piston-powered aircraft under its 5,815 aircraft expansion program. The Douglas DC-7B is the last series aircraft to be delivered before Liquidation delivers the first of Eastern's fleet of 40 Electra long-haul aircraft. First Electra delivery is scheduled for September.

► Preferred Aviation Inc. is in final negotiations with stockholders, on the first quarter of 1958, on the airline's first delivery of the Fairchild F-27 as soon as possible. The aircraft will be used for training purposes during July with three more F-27s scheduled for delivery in August. Two additional F-27s are scheduled for delivery in September and October.

► Trans World Airlines has had formal written with the Civil Aeronautics Board for temporary suspension of its service at Tegucigalpa, Honduras. TWA says Civil Airlines is a local carrier that will soon begin service between Kansas City-Tulsa and Wichita on the last year prior to resumption. TWA's traffic flow to both Kansas City and Wichita.

► United Air Lines has announced its seventh flight schedule from California to Hawaii, starting with 10 flights weekly in each direction. Test flight flights from Los Angeles to Honolulu have been increased from four to seven and round trip service from seven to nine each week. San Francisco-Honolulu flight plan service is up from five weekly to five and each from seven to nine.

► U.S. Post Office Department's new airmail 7 cent postage stamp will feature picture of a composite transport aircraft. The stamp will be available on Aug. 1 when the new postage rates go into effect.

► Flying Tiger Line, as freight revenues during April reached \$342,256, the last rate ever recorded for that month. Traffic showed a 14% gain over April 1957 when revenues totaled \$321,012.



The Avro Arrow is shown in flight during test maneuvers over Ontario.

The Avro Arrow is a fighter-bomber having supersonic flight capabilities.



The Avro Arrow is big as a World War II bomber yet took off on its first flight in only 1,000 feet of the 11,000 foot runway at Malton.



AN ARROW IN THE SKY

Since its first flight on March 25th, the Avro Arrow has been meeting the vigorous demands of its extensive flight test program. Proceeding according to plan, the Arrow flew faster than sound on its third flight, and more than 1,000 miles per hour on its seventh flight.



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MISSILE ENGINEERING

Bomarc Checkout Unit Simulates Flight

Dolos Missile, currently developed for the Bomarc missile, can provide an operational checkout of the interstage missile guidance system by simulating flight motions.

Bell Telephone Corp. from a Farnsworth Electronics Co. design, the Bomarc flight simulator can be used for preflight checkout of the missile when it goes into storage at operational bases. It can also be used for postflight checks.

Part of System

Simulator is part of a complete system for checking out Bomarc and its components being developed by Farnsworth.

Space Capsule has built three of the interstages, and three others are being fabricated by Bohlen Linn Company.

Bomarc missiles have been delivered to Cape Canaveral, Fla., and to Boeing Airplane Co., Seattle. They are used in the test program now, but they are designed for use as operational test equipment to keep Bomarc in peak condition in the field.

The missiles have yet to be used in combat.

Missile controller can simulate roll, pitch and yaw motions. Missiles are clamped to the machine and put through a series of automatically generated tests.

Program provides a readout on the instrumentation system from launch through to the missile to terminate testing.

Excuse is a 30,000 lb capacity of heavy steel frames and complicated linkage.

It is 26 ft. long and 10 ft. wide, and its 18 tons base is bolted to a concrete pad.

Above the extensive main base are three separate frames. One frame is attached to the base through a central bearing, and the pitch frame sits on the vertical rod and is attached to it. The roll frame is connected to the pitch frame, and the yaw frame is clamped to the roll frame.

The 7,000 lb. dummy used to test the system is hoisted with an overhead crane, and programmable fixtures will be loaded the same way.

Can be Traced

Unique feature of the system is the fact that it is a dual system. Its frequency of motion is two cycles per second, and this rate is constant to all three rotation. The machine is driven

by a standard type of hydraulic system.

Temperature rise is low to get maximum damping and amplitude. Spring effect is simulated by a boost to the hydraulic system, while the motor automatically feeds impulses which are just strong enough to supplement the spring motion and maintain amplitude.

Two linear motors 4.5 in. from the center line on each side drive a total movement of 7 in., and other motions are on the arms under. Missile goes through yaw, pitch and roll motions one at a time, and when one form is in position, the two other frames are locked. Testing can move from one motion to another in any sequence.

Hydraulic Locking

Gear frames are locked by hydraulic cylinder which does not press locking at resonance. The machine is additionally equipped with an emergency safety switch which shuts it down when

amplitude exceeds the operating rate.

Machine is driven by a variable displacement piston pump with booster. It runs full out to run the user in all motions, but it is pressure limited up to 1,000 psi.

Booster is attached to the roll frame with two large clamps. Guide shaft has an elevating nose mechanism which presses against the missile's tangent sub-edges, giving added rigidity and a leveling effect.

Air Transportable

Missile controller is air transportable, along with the rest of the Farnsworth system.

Examiner's portability is limited by the fact that it needs a concrete pad.

Hydraulic system has 90 percent of test equipment for checking out the missile and its components, all of them of a go/no-go type. System is designed for use in addition, areas with no extensive technical training.



Jupiter Nose Cone Survives Re-entry

After successful flight on flight from Cape Canaveral, Fla., Jupiter intermediate range ballistic missile nose cone is recovered and packed into metal shipping containers for top back to Army Ballistic Missile Agency. Absence of nose surface, apparent here, served to keep reentry heat from penetrating shell and cushion cone to insulate interior.



MAGNETIC tape units behind control console of IBM 709 computer data processing unit.

Norton AFB Will Process Data To Expedite Missile Logistics

Sgt. Bertrand, Calif.—Electronic data processing center for down-sight part of ballistic missile program will be established here at Norton AFB. Scheduled to be completely operating in July, the center will be assigned by Directorate of Ballistic Missiles, just formed for the function in Air Materiel Command's San Bernardino Air Materiel Area, headquarters located at Norton.

This processing center will be able, in a matter of seconds, to handle digital data inputs from programs associated with the Atlas and Titan intercontinental ballistic missiles and Thor intermediate range ballistic missile, and to expedite assignment actions in connection with supply, maintenance and other functions. This automated capability will allow timely and fast liaison between AMCs' Ballistic Missile Manager, Maj. Gen. Roy L. Park, ballistic missile operating squadrons, supporting AMG bases and missile contractors to facilitate vital action in minimum time. In some cases the system is expected to reduce stock supply requirements from 45 to 15 days.

Heart of data processing system is general-purpose digital computer, International Business Machines Corp.'s IBM 709. Computer will accept data from operational units, gain information to weapon system storage files, digest or correlate, and act as source of swift responses. Transaction information will come via transceiver networks in and out of the control bus.

Input, fed into interface circuits. The transmission system will connect the data processing center to the AMG transceiver network and with Air Force administrative telephone network. An erector.

Number of instantaneous data processing centers available on system module is limited only by space considerations.

IBM engineers, in cooperation with several other communication areas, factory engineerings, in developing specific sets of operating procedures with successors.



MAGNETIC tape units at Norton AFB store data relating to ballistic missile logistics.

In the area of inventory control, the control will:

- Permit worldwide accountability and control of assets, consumable supplies and parts up-to-date record data.
- Facilitate management and budgeting computations.
- Enable ballistic missile managers to balance stock levels at all storage points.
- Allow accountability of disposal and obsolescence of components.
- Give accurate data for most economical use of transportation.
- Aid in cataloging and planning of maintenance schedules and workloads.

About 300 Air Force personnel will be on 24-hr. duty at the processing center.

Five full-time IBM technicians will be assigned there to handle the center's equipment maintenance.

IBM 709 computer, expanded greatly at Norton by the addition of three auxiliary components, will include 10 magnetic tape units, each capable of storing five million bytes of information. System is expected to ultimately require more than 3,000 reels of tape at its library.

Industrial test that Air Force is also thinking of applying the electronic data processing system to aircraft logistics because of its potential advantages of weapons systems.

In such a case the processing system would have to be faced with small problems of the weapon system.

Ken Patterson, associated with the processing center at Norton are Maj. Gen. E. W. Anderson, commander of San Bernardino Air Materiel Area, Col. Philip B. Steele, heading the newly created Directorate of Ballistic Missiles, and Col. Robert U. Kirby, who will direct techniques in the operation of the center.

British Conducting Shock Tube Tests

Teddington, England—None greater of shock-wave research at the National Physical Laboratory here has been conducted. British scientists of two groups:

- Shock tubes are model tools for hypersonic and physical studies.
- American data, obtained in about a dozen shock tubes in half-a-dozen laboratories, is "spotty" at best."

National Physical Laboratory's large-scale shock tube, built as a development item for a planned tube, has a 10-in. dia. in the driver and a 15-in. dia. working section. Much numbers of approximately nine can be tested at a time, based altitude of 200,000 ft., with an upstream pressure of 200 atmospheres.

Bigger Tube Planned

The next tube will be double the diameter in the driving section, and will measure Mach numbers up to 20 and ultimate down to about 20,000 ft., creating upstream pressures of the order of 1,000 atmospheres.

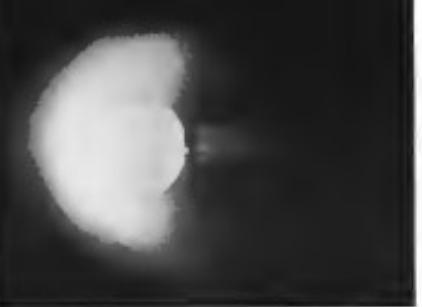
In addition, National Physical Laboratory scientists have designed a 1-in. dia. tube and are now operating a small water-cooled electric air tunnel. If funds become available, they intend to build the larger tunnel and may possibly move it to a concrete tank for operation of the electronic tunnel similar to the "blowby" tunnels developed by engineers of the Air Research and Development Command's Arnold Engineering Development Center (AW Eng. Eng., 24, p. 9).

Scientists working on the shock tube team acknowledge the leadership of the U.S. in this area of investigation, and cite the number and variety of these installations in America. "About all we've done so far," said one, "is to confirm that American are accurate and highly useful data."

Photography Objective

A basic investigation at the National Physical Laboratory shock tunnel concerns the physical mechanism of shock. The whole problem is to get a brief sequence of pictures on the shock wave passing through the tunnel, at the rate of a thousandth of a fraction of a microsecond. A standard halogen camera of the Compton-Schuster type has been adapted by National Physical Laboratory technicians to do the job. The camera takes eight pictures in sequence at the rate of about three per microsecond. Hooked into the audience rotation, the camera supplies eight high-intensity pulses of light made in a quick trip.

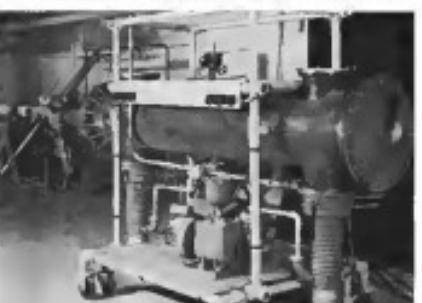
The light sources are spaced on a



SPHERE at British National Physical Laboratory represents shock tube glass at point of shock Mach 9, measured distance of about 200,000 ft., maximum temp. about 7,000°.



TWO bursts of heat of shock wave shown on resistance thermometers. Hypersonic aerodynamic studies are made in 1-in. working section of British-developed shock tube before.





Carrier frames for USAF's Titan intercontinental ballistic missile are being constructed at Kaiser Steel Corp.'s Steel Fabricating Plant at Fontana, Calif. Above, heavy-duty rivets of these frame structures are welded. The Motor Co. is prime contractor for Titan.

Titan Missile Ground Support Equipment Includes Steel, Aluminum Erector Tower



Overall view of lower steel section of tower is shown above. Bottom photo shows the aluminum mast and ladder which can vertically alongside the interior tower for the complete height. Acute platforms to different levels of the tower are at the right of the structure.



and around the central base of the vehicle system, and register the picture in various stages on a standard photographic plate.

In the proposed static shock tubes, three-reactor-cooled engines are equipped to burn fuel to match the electron density of a hydrogen shock system. The importance of such a study is based on knowledge of the high degree of ionization of air at the nose of a ballistic missile.

Tracking Telescopes Use Special Gears

Reduction gears of an 8-ft. dia. auto-telescope for tracking missiles, satellites and stars has a maximum gear ratio of 1,440,000:1.

Total reduction of the drive is a 33-to-1 ratio, data sheet says, enclosing what's greatest. Stepper motor is cast into the central diameter of the ring gear of a large ball bearing which supports the planetary assembly. The helical wave pads around the gear at a rate of one revolution per day.

Gearset was bidleted by General Drive Div., Division, Malibu Field, Co., Detroit, Mich. D. S. Kirsch & Co., Cohasset, Mass., is in the process of bidding six of the telescopes for installation in various parts of the world.

Bomarc Control Job Goes to Westinghouse

Westinghouse Electric Corp. will design and test an advanced ground control system to guide the Bomarc air defense missile. Contract, approaching \$10 million, will be underlined by the company's Electronics Division, Baltimore, Md. Project chairman for the project is Boeing Airplane Co.

Project, concurrent with Bomarc's overall advancement, is Bomarc weapon system, now in development, and will consist of the missile to a point where Bomarc's built-in terminal guidance will take over and lead the missile on target.

Advancements called for include control of the missile over long range, ability to "track" information automatically with other Bomarc ground stations, reduction of equipment size and the ability to track space targets simultaneously.

Lockheed Division Expands Navy Polaris Development

Lockheed Missiles Systems Division will expand Navy-owned Polaris development facilities at Sunnyvale, Calif. Official and accelerated tempo of latest Polaris program has advanced second phase site originally set for mid-year



Draped with heavy current protection cover, Jupiter intermediate-range ballistic missile is loaded onto Douglas C-134 for shipment from Army Ballistic Missile Agency at Huntsville, Ala., to USAF Missile Test Center, Cape Canaveral, Fla. Jupiter is transported by ground rail or air. First missile (EMI) came east to successfully survive reentry into the earth's atmosphere was launched by Army Jupiter from the USAF Missile Test Center, Cape Canaveral, Fla. (AP Wire May 25 p. 30).

Jupiter Prepared For Launching Test



Mobile technicians work on one section of Jupiter (arrow, left). He probably is adjusting antenna alignment. Position of gantry arms is at right of picture. Photo at right shows mobile missile and support complex, with gantry in position at the launch pad. Extraneous tools are made on mobile and its mobile equipment will get prior to the initial launching. Gantry moves to a safe distance soon before Jupiter fires. Markings aid visual tracking.

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automatically compensates for imperfect alignment of pins, enables it to withstand rough treatment, high shock and vibration.

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NEWS FLASH! Cole has now miniaturized this principle for plugs similar to AN connectors and will consider special developments.



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New Miniatured Induced Substrates Using Cole Connectors for ground-plane circuit boards
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AERONAUTICAL ENGINEERING



FLIGHT view of McDonnell F4H-1 shows aircraft in radio position, gear and flaps down. Note extended boom in horizontal tail.

F4H-1 Stresses Range in Navy Order Bid

Navy's new McDonnell F4H-1 jet fighter, which has just made its first flight, appears to be another considerable improvement over the Chance Vought F4U 1 at altitude below 40,000 ft, since both aircraft have some speed burst above

and cruise back to normal. With nose even lower down, the F4H would probably maintain its altitude longer.

However, F4U 1 has greater altitude capability, lessons of Soviet engine maneuverability and high performance of Chance Vought aircraft that would be superior above the 18,000 ft altitude, observers feel. Aircraft made its first flight last week.

Carrier Aircraft

Both aircraft are designed for Navy carrier service but apparently the closer tail design is actual mass savings.

McDonnell F4H-1 reportedly has greater range and can perform traditional same mission of carrier as assigned earlier, later while waiting for target, engage in combat for five minutes,

and cruise back to normal. With nose even lower down, the F4H would probably maintain its altitude longer.

However, F4U 1 has greater altitude capability, lessons of Soviet engine maneuverability and high performance of Chance Vought aircraft that would be superior above the 18,000 ft altitude, observers feel. Aircraft made its first flight last week.

The McDonnell fighter wings set nose high 45 deg. Aircraft weighs set tail and under observer (AW Int'l, p. 21). Powerplants are two General Electric J79 engines producing 10,000 lb thrust each, one titanium sheeting set twin tailpipes.

Engine intake appears to be variable geometry type in which a hinged flap opens and closes for maximum efficiency, similar to that used on Convair F106. An otherwise unknown F4H-1 also is equipped with drag chute to slow landing roll.

Antiaircraft Wings

Antiaircraft wings are said to improve visibility and control by offering 33 deg. negative dihedral of horizontal tail, especially at high angles of attack. Unusual tail configuration also offers improved pitchup tendencies.

Plane can be equipped with four Sparrow III air-to-air missiles and also is capable of long range delivery of conventional and nuclear bombs. Aircraft has the lowest gross weight of any Navy jet fighter.

Refueling can be accomplished at supersonic speeds by probe and drogue or by buddy system.

The aircraft is 56 ft long, has a wing span of 38 ft 5 in.

J. S. McDonnell, president of McDonnell Aircraft, said 4,200 employees now are working on the F4H-1 project. He said 6,000 workers were employed on the design and construction of the initial aircraft before its first flight.

Discussing the economics of McDonnell Aircraft's entry into the supersonic, carrier-based interceptor field, McDonnell and analysts of employment at the company would be dependent to a very considerable de-



SHARP SHOT: precisely control intercepts can be made in this F4H-1 carryout view.

use on the Navy's acceptance of the plane for combat production."

F4H-1 Subcontractors

He stressed that approximately 1,900 subcontractors and suppliers from 25 states are involved in the F4H-1 program.

About 400 of those companies are located in the metropolitan St. Louis, Mo., area.

"The ability of our planes to destroy enemy aircraft is no longer dependent solely on speed, range or altitude capabilities," McDonald continued. "To

do the job today, our planes must be considered as part of a complete weapons system that also includes target pods, novel detection means and guided missiles."

He referred to the advantage of radar operation in missile design and added:

"The fact that the F-4H-1 has two engines is certain to mean a higher survival rate in training and combat operations."

F4H-1, he continued, is designed with a "special allowance for growth potential."

Kaman Laboratory Construction Starts

Bethel, Conn.—Kaman Aircraft Co. has broken ground for new engineering laboratory building which will be completed Sept. 1.

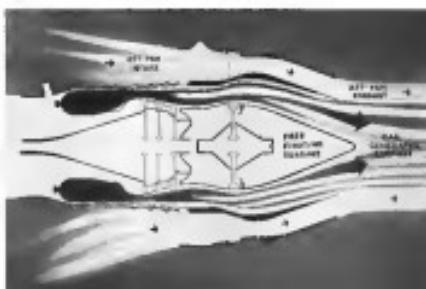
Laboratory, which contains 9,600 sq ft of floor space, is located near 14,000 sq ft engineering and administration building now under construction.

New laboratory is steel frame with aluminum walls and two ribbed galvan steel roof panels.



General Electric Tests Aft-Fan Turbojet Engine

Military version of General Electric's CJ-695-21 aft-fan turbojet engine is shown above being wheeled into test vault. Engine is being readied for flight test in USAF's X-15. It has undergone several months of testing at General Electric's Evendale, Ohio, facility (AV May 26 p 31). Aft-fan component (right, shielded) shown at final assembly stage, is added to basic gas generator in three sections. Test instrumentation is visible. Row linear supports for fan wheel is not mechanically coupled to CJ-695-21 engine balance section. Fuel consumption of the engine (flight) shows fueling by line which draws fuel, via tank, into nozzle. Fueling nozzle is supported by a bearing at neck end of the shaft. Power turbine stage is supported by central shaft.



Hiller Assembling Prototype Tilt Wing X-18 for Air Force

Hiller Helicopters' artist's conception shows a tilt wing aircraft transport of the future indicated that the aircraft would be designed to operate from bases over metropolitan centers. Tilt wing's versatility would permit conventional takeoffs and landings from conventional runways with reduced fuel usage. Below, Hiller contracts Air Force X-18 tilt wing research transport at Palmdale, Calif. Tilt wings of the first two wing sections at the hangar end. The wings will tilt at 90 degrees.



T53 Designed for Maintenance in Field

By Erwin J. Rothan

Stafford, Conn.—Design of Lycoming's T53 860-shp turboshaft engine is aimed toward ruggedness of the surface of some major casting as an attempt to provide reliability in the field where maintenance of maintenance facilities and trained personnel may be available.

Primary consideration was given to the Army mission involving operations close to the battlefield.

These parameters resulted in the T53 having these basic features:

- Comparison of available configurations for the first five stages plus a centrifugal impeller as the final stage. Reasons for this, in addition to reducing the engine's weight, was to avoid high number of part sizes resulting from different numbers of axial blades that favoring engineers left would increase initial manufacturing costs and spares requirements and also be more susceptible to foreign object damage.
- Configuration of annular external air ingestion which leaves the propeller intake as part of the combustor assembly, providing short length. Quick removal provides access to all engine hot parts, reverse flow design is used at even radial temperature distributions at the turbine inlet to increase life of turbine components.
- Turboshaft output shaft passes through the T53 hollow compressor shaft at long reduction gearing, and power output is placed at the end front arm of the engine. Short engine length aided this placement of the shaft.

Market Potential

Lycoming's General Electric stock is placing a wide industrial market for its T53 (AVN Mar. 17, p. 12). Lycoming is exploring numerous applications of the T53 for aviation and military use, including ground power generation and in mobile vehicles. Like the T58, the Lycoming engine is also being studied for use in Navy's new class of hydrofoil-equipped high speed landing craft, in which several research contracts have been let.

Aviation applications that will receive production programs such as the Bell UH-1 (through H-40), Kamov H-4B, Vertol 107 and Grumman AG-1. Major combat aircraft systems include the Boeing 707-320, ditched fuel VIGAS aircraft, the Bell V-22 tiltrotor, the Boeing YF-12A, and the Vought F-8U-1000 VTOL, in search plane and the Vertol 76-90 wing VTOL. Test bed installations include the Korean F-86K, and Vertol 105 helo-copter. Engines have completed a total of more 1,800 hr of operating time.

with approximately 450 of frost being flight time.

T53-L1 recently passed an 110-hr USAM qualification tests at 860 shp rating, an improvement over the T53-1, it was rated at power is the test. This qualification trial was of considerable importance in the Stratford plant concerning that USAF Army had issued a contract for 100 engines, including approximately \$10 million value. Initial delivery of engines next January. Engines contracted for are scheduled for the Bell UH-1 and Kaman H-43B helicopters.

Locating production plans call for initial output of four or five T53s monthly; company expects to produce in excess of 100 engines by 1963 with production growth to approach 50 T53s a month.

Cess Should Drop

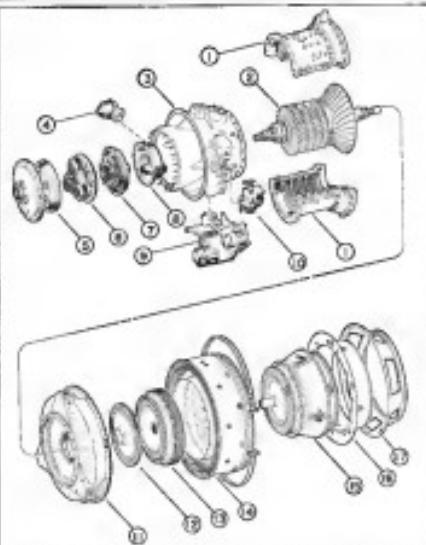
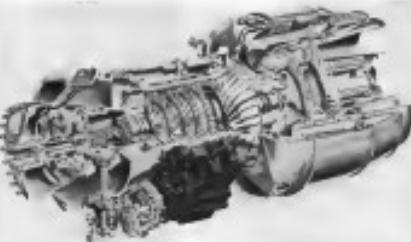
The production quantity can bring cost of the engine down to \$85 per horsepower, further decreasing the projected \$70 per horsepower in 1962.

In addition, the T53-L1 turboshaft, Lycoming is also creating a market for the turbogear engine, designated T53-L3, designed to deliver a maximum net thrust power of 860 shp plus 113 lb. rated thrust for a total of 1,085 shp at 1,780 propeller shaft rpm and providing specified fuel consumption of 6.5% at takeoff power. Fuel specific is slightly improved over the T53-L1, which goes at 6.73 lb./shp/hr at military power. Installation include single and dual configurations, the latter providing high takeoff power with advantage of being able to shift one engine drive for up times cruise characteristics for conventional or military missions.

Lycoming believes developing the T53 turboshaft engine to assist their 1,000 shp in increasing operating time potential, and plan to develop the T53-L4, a plain shaft version. Current version, delivering 860 shp, could be boosted to 1,650 shp using new gear ring arrangement and further power gain made in 1,200 shp by incorporating more numerous stages in compressor.

Also in the works is the larger T53-L2 delivering 1,075 shp at takeoff at 1,620 propeller shaft rpm, and specific fuel consumption of 6.6% and a hub-shaft version the T53-L3 with similar performance characteristics. T53 weight is about 680 lb. As yet Lycoming has not been able to develop sufficient technical interest in programming these more powerful units. T53 is currently running in the test stand.

T53 is a multi-rotatable compressor designed to reduce pressure ratio of approximately 1.7, consists of nine stages holding stainless steel blades and non-clap blades for the initial stages fit-



BASIC MAKEUP of T53-L4 is no surprise in forward, mid section, and in rear view. Major components of propulsive module: 1. Right compressor housing and case assembly, 2. Compressor rotor assembly, 3. Air inlet housing, 4. Main oil tank, 5. Power output gear assembly, 6. Turbogear center and gear assembly, 7. Propeller air gear assembly, 8. Accessory drive gear box and oil pump assembly, 9. Accessory drive case assembly, 10. Combustion chamber and turbines, 11. Diffuser and stage nozzle assembly, 12. Fanstage turbine wheel, 13. Standardized nozzle assembly, 14. Combustion chamber assembly, 15. Power turbine support assembly, 16. Free shaft assembly and 17. Support case assembly.



AXIAL-CENTRIFUGAL COMPRESSOR is designed to keep number of blade stages and engine length to a minimum. Turbine output shaft passes through the compressor's hollow shaft to prevent placement of reduction gearing and power output at forward, cool side. Lycoming has plans to make centralized stage of turbines to reduce engine weight and acceleration time. Below, the jet propulsion engine can be seen in their test assembly at Stratford plant.





INTERNATIONAL DELINQUENCY

Nuclear weapons ready to be delivered by jets and missiles are vital. But in cases of international delinquency, they would be like city police using tanks to prevent a rumble by juvenile delinquents.

United States Navy carrier groups, like cops on their beats, protect our citizens, make rescues, and keep the neighborhood quiet. If called on, they can restore law and order with a wide choice of weapons from a complete arsenal. Carrier groups are also our best protection against submarines capable of launching missiles, plus being a deterrent to all-out aggression.



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COMBUSTION CHAMBER, with power nozzle can be removed as a unit for ready access to engine hot parts without need for taking out engine ring.

led together with five spacers. The usual compressor section and the centrifugal rotor are held together by a sleeve which is screwed into the compressor shaft itself.

First ring, forming a bearing support and, at start, after first rings are above rated speeds, sleeves are shot.

Titanium Proposed

Centrifugal rotor in current production engine is steel, but Lycoming is planning to use Ti for blades. For this kind of a low-cost model, cutting some 11 lb from its weight and reducing acceleration time by 1 or 11 sec.

Compressor blade sections, which will pass returned air to the blade cavities, blade dovetail has a flat instead of a flat, apparently halfway across.

For mounting, blade is slid over a rib washer until the half slot hits the stop pin, then the portion of the rib washer pointing out is bent upward, holding the blade in place.

No 151 compressor has been lost in operation. Lasting report, company notes that fibration of the blades prevent them to bend, unless there is a fault, should not occur for any object such as shot. One engine required a quickmatch bolt that came free from another part of the aircraft, after the engine was shut down and re-started. But compressor blades were bent and broken but none of these had broken loose.

Compressor housing is a magnesium casting split longitudinally, bolted together for ease of disassembly. Some blades are cast from 100% mag of solid cast and are of constant radial shape. Production cast of these blades is estimated at 16 cents each.

The rows of stators are fastened to inner and outer shrouds, three rows holding each stage on each upper and lower half of the housing.

Arbiter prevention uses a helical valve blocking forward from the centrifugal compressor, taking 400-500 deg air to the inlet housing to protect the inlet guide vanes on top and two horizontal struts.

Diffuser Combustion Area

After leaving the centrifugal feed compressor stage, the air is channeled through a diffuser section containing straighteners, which is designed to eliminate the swirling and also reduce air velocity prior to combustion.

Engines diffuser section is also the main support area for the engine, providing there mounts, supporting three mounting points on the inlet housing. Section also provides support for the engine No. 2 bearing.

Combustion section is held to the diffuser with a hole circle that allows the combustor and power nozzle to be accessed easily from the engine for cleaning the combustor or for access to both turbines.

Engines hot parts are designed for use in combustion. Power nozzle is supported within the exhaust diffuser, which is part of the combustor assembly. Entire assembly, including combustor, can be removed from the engine without disturbing either rotors or parts.

Removal of this assembly provides access to combustor base, fuel vaporizer, turbine wheels and rotors.

Automatic combustion system takes from the delivery pipes it between the base and housing and then through holes and bores into the combustion area, where it is mixed with hot vapors. Openings in the lower pipe throat are used to conduct air into mixing combustion, other holes assist in flame propagation.

Engines power control is a simplified



COMBUSTION ASSEMBLY spin, showing power nozzle, right. Power nozzle is supported within exhaust diffuser, which is part of T91-L15 combustor chamber assembly.

base nozzle and the first stage turbine wheel.

Turbines are single-shaft units consisting of nozzle, wheel and shaft. Two loose needle bearings of an outer ring to which vanes are welded to form the nozzle. Turbine wheels which are made up of solid wheel disks with each blade held to the rim by a pin through the wheel rim and the blade root.

First stage nozzle and first-stage fan base wheel, together with the axial centrifugal compressor, diffuser and combustor, make up the gas generator assembly. The second stage and interstage bearing clusters connected to the gas producer wheel.

Power turbine assembly is composed of the second-stage nozzle, second-stage turbine wheel and interconnecting shaft and gears to the engine output shaft. Planetary gearing reduces power turbine speed 3.23:1. Reduction gearing is located forward, at the engine's "cold end," to provide greater reliability and life of gear and highspeed bearings. T91's unique design is such that rear drive is eliminated, as well as power output at both ends, so it can be readily handled.

Compared to the previous system, the power takeoff for auxiliary drives, providing up to 50 hp.

Power Control

Fuel and power control unit is grouped in the wrap-around section of the engine to maintain maximum diameter, which is part of the combustor assembly. Entire assembly, including combustor, can be removed from the engine without disturbing either rotors or parts.

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angle lever. Normally, fuel power to base solar speed is controlled by the power to base gear Governor, gas pressure. Engine speed governs pressure the engine from idling or combustion bleed-off due to random changes in power selection. Power control lever covers four positions: 0 to 95 deg., 0 to 100 deg., 0 to 115 deg., 0 to 125 deg.

Means as the project have been carried out by Walls.

Walls, he said, was selected to design last September because he believed he was on the level of one of the most important inventors of his age, the man who invented the airplane. He deserves it, he said for this reason. Power, control lever covers four positions: 0 to 95 deg., 0 to 100 deg., 0 to 115 deg., 0 to 125 deg.

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• Replacement for Cessna's Socorro: The Socorro, the Lockheed NAA 30 (AW May 13, p. 3), will be heavily considered, but it may be necessary to refine a second strike aircraft which is appropriate, it was stated.

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Minister Adds Details On Swallow Project

LONDON—Further details of Vickers Swallow project have been given by a government spokesman in the House of Commons.

Group Captain Andrew Jacobs and research on the variable geometry aircraft had been underway 10 years when it was decided best way to move beyond fundamental research to the construction of an actual research aircraft (AW May 19, p. 34).

Vickers Armstrongs was invited to submit a proposal based on the Barnes Wallis research.

The proposals were for the construction of a research aircraft which might prove the foundation for a heavier to succeed the supersonic bussard," Jacobs said. "In other words, it was a research aircraft which might be the foundation for a post-supersonic bussard."

The supersonic bussard, however, was canceled following the 1957 Defense White Paper.

Accordingly, I informed Vickers that the proposal in the form in which they had submitted it could no longer rank high on the list of priorities, Jacobs said.

But I added that the Ministry of Supply will still extensively interested in the whole principle of variable geometry and is prepared to support alternative programs which would apply the principle in a different form, a form different from that of the supersonic bussard."

The minister said that since then, certain alternative proposals have been assessed from Vickers. These are being reviewed by British and U.S. Air Force officials.

Vickers reportedly is continuing the Swallow project at its own expense. Until government support was withdrawn, Ministry of Supply has given about \$100 of Ministry funds, with compensation paid by the contractor.

Jacobs challenged a Member of Parliament who declared: "It is a result of false alarm or false economy, Dr. Barnes Wallis is down out of his money. I shall do my best for the rest of my life to find out who was responsible and expose him in the public eye." He and some 775,000 investors

were using the Swallow as a heavy freighter until the mid-1950s. It is in the following period that a successor is being sought.

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COAXIAL Ka-15 helicopter is powered by 250 hp engine, has top speed of 90 mph.

Coaxial Ka-15 Designed for Utility

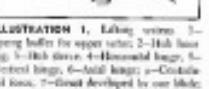
Russia has disclosed some features of its new coaxial Ka-15 research helicopter which it calls the "Swallow."

Together with the Lopush, the Ka-15 is lauded by the Soviet press as another example of Russian aptitude in aircraft engineering. The USSR claims that "notwithstanding many strengths to bring coaxial helicopters in the past, of general utilization in foreign countries, nobody [has] yet succeeded in doing it."

Designers N. I. Kuzov, who helped build the first Soviet autogyro—the Rakhmanov—in 1928, started planning his first coaxial helicopter in 1949. His colleague K. I. Slobodchikov, died in 1952.

The Ka-15 is powered by a 250-hp engine, has a top speed of 90 mph and a range speed of 76 mph (AW No. 25, p. 58). Range is 28 to 4 hr., and ceiling is 18,000 ft.

Special attachments permit using the





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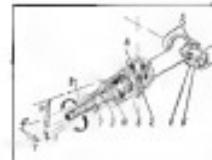
A line of rugged, lightweight transformers specifically designed for high-acceleration, high-shock applications has been developed by Westinghouse Electric Corporation.

High resistance to extremes of pressure, vibration and shock makes these transformers ideal for many applications in both piston-powered and jet aircraft, as well as in high-thrust applications emanating just above missile-launching pads. Fitted with form-fit cases, these new transformers have no resonant points to well above 500-cycles vibration and are shock-tested at 50 g's per axis. They are completely insensitive to very high differentials of internal or external pressure.

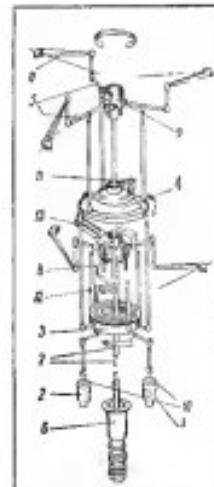
Now in production at the Westinghouse Greenville Plant, these new transformers are available in ratings from 10-wa through 5-kva, single-phase or three-phase, 400 cycles, 2500-watt test.

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MAIN drive, 1-horizontal hinge, 2-vertical hinge, 3-spool hinge, 4-tensioner, 5-spacer for horizontal hinge bearing, 6-spacer for horizontal hinge, 7-middle shear hinge for mid hinge, 8-blade pin, 9-thrust bearing for mid hinge.



COMTRIM, return air exhaust, 1-speed for longitudinal control, 2-speed for lateral control, 3-speed for vertical control, 4-speed for collective pitch, 5-speed for differential pitch, 6-speed for roll control, 7-speed for yaw control, 8-speed for pitch control, 9-speed for roll control, 10-speed for yaw control.

Ka-115 for operational, maintenance and repair work. According to Krasov, coaxial helicopters have better landing qualities and are more economical than single rotor designs. He adds that the coaxial craft can be built smaller and more economically.

Pilot Training

Soviet helicopter engineer V. Bryukhov points out that coaxial helicopters such as the Ka-15 have advantages in training in pilot training "since the system of control of the aircraft is closer to that of an airplane."

The Ka-115 lifting system consists of two identical motors located one above the other on a single geometric axis.

Turning in opposite directions, the counter-rotating rotors are fastened to one central shaft.

Power from the engine crankshaft is transmitted through an intermediate reducer to a distributing reduction gear. Two shafts come from the distributing reducing gear—a short outer one, for the lower rotor, and a long inner one for the upper rotor. The distributing-reducing gear divides the power between the two rotors and provides their constant rotation.

The Ka-115 tail assembly, featuring twin fin and rudder, is similar to that of an aspirate.

In general, Krasov favors four-wheel landing gear for his coaxial craft to provide better stability while moving along the ground.

Control is Simple

According to Bryukhov, control of a coaxial helicopter such as the Ka-115 is simpler than for a single-rotor helicopter.

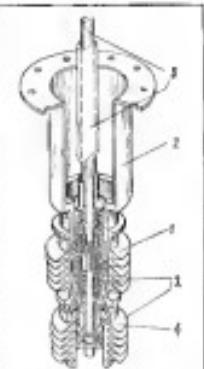
"More difference," he says, "is in coarse (directional) control."

"Longitudinal-lateral control (longitudinal pitch) for coaxial and single-rotor helicopters is similar. The only difference is that with coaxial helicopters, when the stick is raised in one direction there is an approximately parallel tilt in the same direction by both main disks."

"Collective pitch control on the Ka-115 affects all the blades of the upper and lower rotor simultaneously and to the same degree. The collective pitch and differential pitch must operate in unity at the same time in a single-rotor aircraft."

"Coarse (microscopic) control with a coaxial helicopter such as the Ka-115 is achieved through pedal operation by two methods: by differential change of the return collective pitch and by the middle longitudinal shear hinge."

"Operation of all three control devices—coarse pitch stick, collective pitch lever and pedals—is entirely independent."



COAXIAL and differential pitch means: 1—operative pitch device, 2—fixed drive with main blade shank, 3—drive and lever for differential pitch, 4—articulated threaded sleeve; 5—locking control sleeve.

conclusion. Piloting a coaxial helicopter is just basically simplified over the ground where there is a limited landing area containing obstacles. Thus, for example, it is considerably easier to land on a ship's deck or to fly between trees.

Bryukhov says "the question now to start development in the Ka-115 coaxial helicopter is less than for Soviet single-rotor helicopters, but the control effectiveness is greater. Therefore, this aircraft must be relatively low, and its errors after movement in any direction must be smaller."

Rough Increase

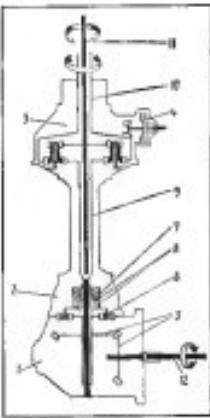
The coaxial lifting system has other advantages. Because of the smaller loading on the disk of each rotor, when rotor conditions are equal at a speed of about 1150 rpm (range 2050-2100), no influence is received.

Getting into turbulence or in vacuous zone is also less dangerous with a coaxial helicopter.

Bryukhov considers that elimination of vibration is still a major problem on the Ka-115 and similar craft.

The upper rotor is carried a long distance from the support on a common part-shaft that has flexible shaft. It is very susceptible to manufacturing discrepancies and vibrations which show up during the craft's operation. Adjustment of the coaxial rotor system

re-lent'less: a missile that pierces hostile sky to pinpoint its nuclear strike



TRANSMISSION arrangement. 1-Motor reducing gear; 2-Combustion chamber; 3-The rotating motor; 4-Rotor blade; 5-Feed gear; 6-Planetary reduce; 7-Fraction motor; 8-Lubricant shield; 9-Drive shaft; 10-Lower rotor shaft; 11-Upper rotor shaft; 12-Dragger crank-shaft.

is most complicated than in the nose with a single-order entry."

Bryant also admitted that placing rotors one above the other creates a danger that these blades will strike when they are turning at slow speeds or when they have to be given sudden stops.

This problem, he declared, can be increased by close observation of operating instructions.

Thor IRBM School Opens at Tucson

Tucson—Douglas Aircraft's Tucson Manufacturing Plant facilities have been formally opened as a Thor intermediate missile ballistic missile school for USAF and National Guard Air Force personnel.

Program represents a cooperative venture in the interests of expansion of training activity which has been under way in some form at manufacturing facilities and other locations.

Entire program is under contract to Douglas from USAF's Air Training Command.

Approximately 90% of personnel will be RAF personnel. Both officers

Science Conference Draws 480 Students

Los Angeles-West Coast Student Conference of the Institute of the Aerospace Sciences held here recently drew some 480 applicants from colleges and universities, more than double the number of last year.

Nine undergraduate and two graduate papers were presented at the conference with Tom Vincent of Oregon State College winning in the undergraduate category for his paper on "An Experimental Verification of Stato-Stability Predicted by Nonlinear Catmull Theory."

Makoto Iuchi, graduate student at California Institute of Technology, won the graduate division for his paper on "Fund Flows."

Conference included plant tours and banquet at which awards were made.

Wright Replacing Cap On Turbo-Compound

Hot resistance alloy steel cooling cap on the rear of the rear-stage of the Wright R1300 Turbo-Compound engine has replaced the nickel alloy cap formerly used.

Purpose of the change is to extend the service life of the cap, which allows to disengage cooling air from the turbine section.

Power recovery section is a source of overhead problems on the engine (AW April 21, p. 39).

Constructed of Ni 15 alloy steel, new cap is expected to withstand the 3,150°F exhaust gas temperatures for over 4,000 hr.

Caps are fabricated from Ni 15 alloy tubing produced by the Alco Tube Division of Carpenter Steel Co., Utica, N. J.

Reprints Available

Reprints of Aviation Week special report on magnetohydrodynamics at the following rates:

1-10 copies .90 cents each

11-100 copies .18 cents each

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Intake System, A. E., or M. E., with instrument design or environmental systems development experience. Develop low-pitch intake system for aircraft. To design and analyze advanced environmental systems and procedures for pilot and crew.

Cockpit Atmosphere, A. E., or M. E., with experience in aircraft interiors and oxygen systems. To develop and design atmosphere systems that considerably prolong air and space crews in vehicles having linear motion driven in the glide plane.

Escape System, A. E., or M. E., with experience in design of escape seats, helmet, harness, seat retention systems, and high-speed ejection test sleds. Escape system experience should be in aircraft development, particularly design for ejection situations ranging from ground level to escape from orbit.

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In minutes, Regulus II can pierce over 1,000 miles of hostile sky to score a nuclear bull's-eye.

The first of the Navy's nuclear-driven subs, designed to root the seas as ocean disruptor, is to begin construction. The missile itself has made over 25 successful flights. Under Navy lead in key locations, it will be a silent killer watching for peace.

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Honeywell currently has pressure transducer equipment flying in such aircraft as the F-89, F-100, F-101A, F-105B, B-58, B-56, B-66, CF-105, KC-135, B-37, B-56 and various missiles and target drones.

For complete information on Honeywell Pressure Transducers write Honeywell, Military Products Group, 2600 Argyle Road, Minneapolis 13, Minnesota.

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HAMMAR IV color, dead of musing, offers good visibility. Wing area is 157 sq ft, including transom-shaped fin.

Airline Week Pilot Report

Water-Stable Skimmer Lands 'Hands Off'

By Robert L. Stanfield

Telamon, N.J.-based short-haul expressman along with other stable, durable, water operators, are key factors of Colonial Airline's new biplane 2-2 Hammar IV.

All-metal amphibian is powered by Evening GMW AIA engine generating 180 hp at 2,780 rpm at 10,000 ft. Engine compression ratio is 8.5 to 1. Fuel grade is 95.9% octane. Fuel capacity is 100 gal, distributed, one tank each.

Flight features include a transom-mounted single-seat cockpit, a trim tab, a fixed tricycle landing gear, and a retractable tailwheel. Water landing gear is a track providing pilot choice for low load. Aircraft, he notes, looks to

do nothing. Amphibian requires no abrupt back pressure. Nose wheel dig and engine run rate on nose without rudder. Steering was handled much better than I had ever seen all by itself.

■ Water stability. Despite many speeds ranging from 20 to 40 mph, the Hammar IV is just like a boat. There were no watercrossing tendencies. Skimming flats add to its seaworthy qualities; airplane won't tip in hard turns.

■ Short field performance. One goes from skid stop to 60 mph in one-half the time of the size of the wings. Results: good lift, plus cushioning effect on landing. Airplane flew off hard surface runway in slightly less than 100 ft, was brought to a stop in 30 ft. Wind-in-flight over 100 ft.

Skimmer is based in operation on lowwater areas. Optimum cruise altitude for best speed and fuel consumption is 6,000 ft. Water operations are not accommodated above this altitude because of power loss.

Thus looking amphibious is rather deceptive sitting on the steps, especially

ing smaller than an adult size. Side of fuselage, which is built 17.5 in from ground, "D"ock gear travel is 11 ft. 7 in. Gear, with long stem travel, is a walk-over of 40 to 50 sec.

Powerplant has mounted with solid rubberized propeller supports. Propeller provides forward-sleek strength and minimal vibration. External side panels provide for lateral loading.

Hold doors down after four separate watertight compartments (both door pings) of them being in use. Mating doors are sealed at top. Airplane's float booms and wing tips are plastic. Can talk in language oft' passenger compartment, who also be classified inだから disease when cockpit or port hole empty.

Airplane flies out N2588, first production model. Skimmer IV, which called me last September, Abdon van Jack Strem, president of Amphibious Aircraft Corp., Teluron, marketing organization for Colonial Airline Co.

With two seated plus crewmembers and baggage equipment, and 20

gal. of gasoline, airplane ground out at about 2,300 lb. Maximum allowable gross is 2,550 lb.

Airplane was created through wind-surfing idea. Waddell is based in center. Either half can be raised up and over until it lies on other half. With either arms, one can stand straight up in cockpit and, if necessary, step to bow of airplane during water exit.

Cabin is roomy and comfortable. Floor is rubber, height is 47 in, at max. 41 in. at front. Width is 41.5 in. Length is 62.5 in. Total length of rear seat to back of movable front seats, length is 39 in. Trunk at the rear of back seat will hold 30 lb. Total cabin length could be increased by removing rear seat.

Aerodynamics in low can be easily machined. These include anchor and decking line, batsey, and boathouse rooms off in separate compartments.

Instrumentation and Controls

Stemmer's engine controls—throttle, pitch, mixture and carburetor heat—are located on control column. Flight instruments are located in front of pilot. Radio, compass, instruments are mounted to right.

Services for lights, print, cabin heat, hydraulic pressure, generator, battery and nuclear light are set up, longitude to pilot's left, along with control for moderately activated water release. Control handles run beneath seats. In addition to engine driven pump, skin-to-dad pump switch is available for starting bilge and loading.

Also control mounted just below instrument panel are gear and flap handles, telescoping emergency hydraulic pump, and gear flip indicator lights.

Specialized hydraulic line valve control handle, which springs back to normal after main application, is located on floor between two seats, so as to prevent break loose.

Pilot stands up quickly and the surprise was total. There were a bar rough seat I adjusted to a forward and posterior banking action. Belts are on pilot's side, cockpit's mobile pedestal are for directional control only and can be folded down flat to floor for additional leg room.

Louising engine has a tendency to run up during turn and full collective heat was needed. There is no prop blank, due to power configuration, and at low taxi speeds air flow does not supply sufficient air.

Magneto was checked and prop ran at 1,500 rpm. Full prop was dropped (blown air only was present), emergency heat was applied to cold, and airplane was ready to go. Wind was from the northeast at 20



HAMMAR IV, with long cab travel, is suitable for 4000 ft. load is 21 ft. 2 in.



AMPHIBIAN'S first biplane and wing tips are plastic, seaworthy sets in billets.



WINGED and water-tight washboard fields offer great safety, low stresses are within easy reach. Cabin is 47 in. high, 44.5 in. wide and 62.5 in. long.

Colonial C-2 Skimmer IV

Specifications

Engines	Lycoming 049A1A
Hp and rpm	150 at 3,200
Payload	
... Blister forged dead, constant speed	
Gross weight (lb.)	2,350
Empty weight (lb.)	1,810
Useful load (lb.)	539
Wing area (ft. ²)	19.8
Wing loading (lb. per sq. inch) (lb.)	107
Length (ft.)	25.6
Height (ft.)	4.2
Wing loading (lb. per ft.)	49
Ferry loading (lb./hp)	134
Drop zone (lb.)	245
Fus. area (sq. ft.)	17.15
Stall drag (sq. ft.)	16.71
Floater area (sq. ft.)	6.70
Rudder area (sq. ft.)	3.41
Total surface area (sq. ft.)	37.59
Fuel capacity (gal.) 50.0% reserve	49
Baggage capacity (lb.)	35

Skimmer Performance

Max. cruise speed (mph.)	150
Normal cruise speed, 75% power (mph.)	121
Stalling speed (mph.)	52
Rate of climb speed, flap down (mph.)	71
Rate of climb speed, flap up (mph.)	86
Rate of climb (ft./sec.)	228
Climbing range (ft.)	380
Fuel consumption (100% power, gph.)	4
Optimum cruise altitude (ft.)	6,000
Service ceiling (ft.)	14,000

ft. with pitch up to -10. Sea level pressure was 10.05 in. Outside air temperature was 60°F.

Once Skimmer started to roll it had unpredictable directional control via braking or steering. Airplane picked up speed quickly and was airborne, with slight bank present, at 65 mph. Take off roll was less than 90 ft. in 100% power. At 100% power and 2,700 rpm.

With gear up, power was reduced to 75% and 1,650 rpm. Angle of attack was held to initial climb speed of 75 mph. This was caused solely by uncontrollable yaw, and airplane climbed out at 90 mph. Rate of climb was 3,600 fpm.

During climb Skimmer was definitely pulled nose high. Steepness persisted as long as 3° wouldn't be safe to still turn itself. With lefting and only working stand of Safe Flight stall indicator, nose was over turned and aircraft continued.

Cabin attitude well ahead of the wing, and wing loadings were steady for good turns ahead, to the side and down, and up. Turning around 3° could get

more movement of horizontal tail surfaces.

Stability was good during climb and the engine supplied power to light control pressures. Skimmer requires minimum amount of elevator pressure.

With engine high and to the rear of cockpit, nose oversteer was possible, once level was attained. Airplane was leveled off at 1,000 ft. and headed for nearby Hackensack River. At this altitude, with 75% power—245 ft. and 2,400 rpm—indicated air speed was 121 mph. Approaching the river, engine-out procedure was simulated.

Pilot cut one fuel, full carburetor heat applied, and full flaps dropped. Lowering nose, trim was set and Skimmer spiraled down at 65 mph. Approach wasn't too steep and control was good. Approach was held on high rate because of strong gusts.

Airplane was held off over water until need to roll in. Controls were affected and control surfaces became slightly begin drooping in. Water was somewhat shallow and would catch a bit of spray, but there was no digging of hull nor was there any bottom resistance. No back pressure is necessary.

Propeller ran high enough to increase from water spray, as well as spray, minus air, just as much as wings. Height, plus protection of wings, shield prop and engine from salt spray.

Maneuvering with water rudder down is easy, as the airplane won't

pitch nose at about 50 mph. But



Converted Navion Cruises at 185 Mph.

Navion conversion developed by Tico Corp., Houston, Tex., features 240 hp. Continental engine, McCauley constant-speed propeller, NACA inlets, wing-to-fuselage fairings, dual control wings. Tico reports that its new Model D Navion has maximum cruise speed of 185 mph and climbs at 1,110 fpm at 1,310 rpm, 100% gross weight. Gross weight service rating is given as 17,000 lb. NAV-converted Model D also provides entrance to cockpit over wing trailing edge, a step being provided in the wing fair. Floor has been strengthened for two people.



MERCURY SERVICE NEW YORK - LOS ANGELES

Widest choice of DC-7 nonstops



radar-equipped - reserved seats
spacious lounge - superb cuisine
American's famous
stewardess service



AMERICAN
AIRLINES
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among scientific, military,
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Aviation Week is first

In the rapid-paced, dynamic field of space technology, missiles have captured the imagination and attention of the world. And because Aviation Week editors were on the scene when the first missiles were developed, they know what efforts in research, development and engineering work lie behind the missiles now on the way up. That perspective, the ability to correlate, the awareness of a great industry behind the biggest headlines and smallest component account for Aviation Week's accurate reporting of current events and deep insight into the future.

Aviation Week has been a part of the big events in space technology—Aviation Week editorial texts include such memorable missile articles as *The Anti-Missile Missile* (4/9/58 issue), *How U.S. Tops Soviet Military Secrets* (10/23/57 issue), the two authoritative series on missile guidance—*Interfer Systems* (January 2, 9, 16 & 23) and *Infrared* (March 4, 11 & 18 issues)—and annual coverage of the International Astronautical Federation since its founding in 1950. Aviation Week editors have shaped both technical thinking and defense policy.

Aviation Week gets there fast—to the events, the people who make the events happen, to the interpretations behind the events. And its weekly corner means that technical information arrives fresh, in time to be meaningful.



This kind of on-the-spot coverage has paid off in world-wide and industry-deep audiences... has made Aviation Week the most quoted publication covering missile programs—and all phases of the aviation industry. During 1957 alone, more than 360,000 AW readers were bought by 1,000 U.S. foreign manufacturers, military and government agencies, universities and scientific institutions.

First in Space Technology, Technical Coverage, Editorial Quality and Impact, Aviation Week is number one among Aviation Technical and Management Publications in Circulation, World Wide Distribution and Advertising Income.

Aviation Week
including Space Technology

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An affiliate organization



RELIABILITY or

The Wonderful One-Hoss Shay

A Logical Story

Have you heard of the wonderful one-hoss shay.
That was built in such a logical way.
It ran a hundred years to a day?

"For," said the Deacon, "It's mighty plain
That the weakest place must stand the strain;
And the way to build it is only just
To make that place as strong as the rest."

The Deacon followed the two cardinal principles for reliability.

1. Know the stresses your component will be subjected to (in other words know the environment).
2. Build faithfully to the specifications that cope with this environment.

At CPPC we feel one of our great assets is careful manufacture by a skilled and conscientious crew.

Reprints of the complete, original poem—
The Deacon's Masterpiece or The Wonderful One-Hoss
Shay by Oliver Wendell Holmes and upon request.

LOOK TO CPPC FOR SYNCHRO



FROGGER

CLIFTON PRECISION PRODUCTS COMPANY, INC.
Clifton Heights Pennsylvania

there was no clear break and fall away after a combination of breaking bending, which occurred when the load was lowered at speed increased. Although this was not the main control gear.

Possibly stiff according to specification, could result in loss of 350 ft. With this and gear down, still span was provided by leading and trailing wing which provided break by 2 to 10 mph. Break was smooth at 50 mph and ultimate loss was negligible. Low starting speed is attributed to large, strong fans.

Stability and control of Shimone were excellent during all flight phases. Elevator control is sensitive at high speeds, important because of potential nose-up moments, especially approach set of ungrounded control surfaces.

Control surface areas are maintained rather low to push rods with the exception of a short length of chain and cable in the alien position of the control wheel. Aileron trim surfaces are hydraulically controlled. Trim surface -17% to +8° in area-large amount of control surface on cleaver and prevents overcontrolling.

Shimone was never forced through several hard-earlier landings, with time out for additional practice.

Fuel Consumption

Amphtime averages 8 gal per hr fuel consumption. With 40 gal of fuel, this would allow 4 hr of cruise and return of about 28 min. Range at maximum cruise of 125 mph, would approximate 300 mi plus reserves.

Amphtime is certified at 146 mph. Gear and flap down, and holding 90 mph on approach, rate of descent can be high enough with power off. Getting into a tight slot wouldn't be kind.

From readings were short. Airplane writers, and there is a tendency to lead off too high. Amphtime will rather well down after takeoff and it need not be more than 400 ft. of altitude.

Stallfield landing as mentioned earlier was made to about 100 ft. and 30-40 mph. This page is not the place to discuss downwash and wake. Decent was steep enough to provide vertical stability and airplane settled quickly after rollout. Only moderate braking was necessary.

Shimone's 100-hour rating is based on closer to keep hydraulic fluid out of engine compartment. Amphtime provides rapid shutdown of gear. Electric pump charges accumulator up to 1,100 psi, at which point the electric motor is stopped to prevent waste. When gear, flaps or longitudinal trim surfaces (two hydraulically controlled) are adjusted and pressure drops below 770 psi, the electric pump automatically starts and recharge the accumula-

tive portion of the bus is built up with 14 STI extracted gear over and 24 STI over. Order came in at 24 STI built up channel surface.

Two jett points, one under each wing, are fitted in main wing spar. Chordwise bending strength is provided by an additional strip along the trailing edge of the wing. Control surfaces consist of a brace to provide leading edge strength, with metal outer skin providing required torsional rigidity.

Large triangular-shaped wing fillets add to Shimone's trimapon



Bethlehem Steel Convairs Get Longer Range

Bethlehem Steel Corp.'s two Convair 440 executive transports have been modified by Pacific Aviation Corp. to provide transcontinental range. Standard Convair integral wing tanks were relocated to a point halfway between the furthest outboard wing ribs and the tank top providing storage at fuel weights from 2,750 gal to 2,000 gal. Standard oil tank was increased by 6 gal each to 36 gal. Plates around Pacific Aviation tank except for cockpit. Pacific Airlines applied Lockheed vibration-suppressing bearing plates made to reduce the liquid metal P-1000 tank. Lockheed was forced under pressure through legal battle to prevent sales. Quadrant parking was removed to reduce center of gravity. Mohawk Company test tests reveal average seat utilization of 20 Apache equipped with standard Convair crossfeed. Plane would be modified to take special refueling hoses and drogues. Bethlehem's 440 can run up to 20 minutes with plates on board with Searle RDR-1B-1 X-band weather radar.

use. Filters are necessitated because of negative pressure resulting material by reverse filter effect.

The cost of Standard U \$21,780. Standard equipment includes full seating, four flight instruments plus manifold pressure gauge, interior interior, and sets of clouds, power, and fuel and drain oil cans for each of the cabin windows.

Optional equipment embraces dual control, standard instruments, radio equipment, heater, navigation lights and electrically heated pilot harness. Condition package deal is so far would be in excess of radiates about \$2,800. Cost of necessary equipment

Colonel Sparer that with five passengers, insurance, hangar, rent, direct operating costs and tax funds for supplemental maintenance plan per year and personnel excluded, Standard IV can be operated for less than \$17 per hour if utilized 600 hours per year. Operating costs for two persons are estimated at 7% per passenger mile.

C-2 was certified by the CAA on Dec. 16, 1957. Orders were taken in January and the third and fourth production aircraft last month. First orders total 16, with next delivery scheduled for mid-September. Company is working toward permanent three-month backlog of 10-12 airplanes.

In November of 1951 the firm hopes to be turning out 17 aircraft a month, weighing 3,500 pounds. Standard aircrafts in the U.S. now number eight. Aeroflite has Aircraft plans to add seven more for a total of 15. Top markets for the amphibian are low-altitude water areas in the U.S., Central and South America. In addition to spotters and executive use, Aeroflite's Avocet is just demonstrating airplane's applicability for all class of operation.

Earlier this year C-1 Skymaster, of which 25 aircraft were sold between September 1956 and August 1957, probably will be discontinued in favor of the C-2 Standard IV.

PRIVATE LINES

Robins Aviation Corp. has been formed as result of reorganization of former Robins Aviation Corp., Pontiac, Mich. Firm adds Licensing and Aeronautical distributorships. New offices and fully-equipped radio repair facilities are being built.

Junior John, developed by Aerojet General, developing 250 lb thrust for additional tailfin power, has been named an assault engine type certificate by Civil Aeronautics Administration. Unit, designed for single or multiple installations in aircraft of up to 10,000 lb gross weight, delivers separation of 100 ft for 15 sec duration, angle about 50° to installed.

Berry Aircraft Corp. has been awarded a \$1 million contract from USAF for additional T-38 training aircraft, extending the previous two through spring of 1959.

Wing-ribon ship installation, built in Research Works, Inc., Indianapolis, Ind., 100 hr. inspection for DC-3 to one day, firm reports. Designed on basis of section and rear studies, main part most of needed tools available close to the job have been inventoried at St. Louis' Lockheed and Pomona Beach bases.

Number of airports in New York State increased by 10 in 1957. In a total of 277 landing facilities, Department of Commerce reports. Last fall shows 46 marginal fields, 174 private and unincorporated fields (up 15 over previous year), 11 military air bases, 35 seaplane bases, and seven helipads (three less than in 1956).

Bureau of Reconstruction of Department of Defense has taken delivery of its Aero Commander Model 680 Super, which is fitted for aerial photo work. Based in Denver, Colo., the plane will be operated from short fields, adjacent to dams and power plants.



"Environmental Testing" A Carburetor

When he comes that heavy steel door, an Airwork overhauled carburetor will fly 10,000 feet above sea level. At that foot, the gaskets will tell exactly how well it would feed an engine at that altitude. The inspector will compare fuel flow and air flow with the sea level performance determined by previous tests.

The box is part of an air circuit and bleed test stand that simulates altitude to 20,000 feet. Airwork uses

its performance test chambers at those altitudes where most of their working life will be spent.

That extra test... and the entire equipment needed for it... are typical of Airwork thoroughness. We make sure, before we send them to the shop, that it can't be treated to damage by performance.

It's for yourself, the best insurance quality makes. Send your next engine to Airwork. You'll be glad you did.

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AIRWORK
CORPORATION
Middletown, New Jersey



De Havilland DHC-3 Otter series is a flying testbed for a model of the de Havilland DHC-4 Caribou utility aircraft.

Twin-Engine Caribou Undergoes Testing

First prototype of the DHC-4 Caribou transport utility aircraft is shown being fabricated by de Havilland Aircraft of Canada Ltd. at Downsview, Ontario (below). Second prototype is expected to be rolled out in next month. Five orders have been placed by the U.S. Army for the Caribou. Model at right is painted in Army anti-siluric. Model at right index, a pointed-in white and a horizontal red, a color combination the Army is using on its craft flown in Arctic or tropical regions. U.S. Army Caribou will have Pratt & Whitney R-1830-4 engines producing 1,450 hp at 2,700 rpm for takeoff. Payload will be between 3,000 and 3,500 lbs.



Industry Team Bids on USAF Project

By Carter Lewis

Delta-Wescon, a team group, has been formed by Texas Aircraft Corp and six other companies here to propose a bid on a unique weather reconnaissance system planned by the Air Force. Formation of the group points up some changes in the technical and management setup in the aircraft industry.

The new group is the latest sign in a trend toward group efforts on weapon systems first observed in Avco's *Weka* a year ago (Aviation Week, June 6, 1967, p. 68). And it's a trend that will bring support from the Air Force.

For the enterprises involved, these team efforts mean a chance to partner up to undertake big systems without the big risks involved in these large-scale developments. Besides, there's no need for the smaller enterprises—Georgetown of course, industry plans bidding on the Dynasat project show that for the Air Force, these teams mean more economical use of industry facilities and capabilities and less money spent on leasing new facilities and developing new technical skills when those skills already exist.

With the group effort, new combinations of skills needed can be brought together when the team is being formed. This cuts into the former practice of developing needed new skills at USAF cost as single companies working on complex systems.

USAF has suggested that in various ways Delta was a leader in American business in the development of aircraft systems. Captain William T. Thomas, Deputy Director of Procurement and Production. In this letter, which was distributed to the industry, Thomas observed that growing complaints of weapon systems will increasingly require proposals from system manager and subcontractor combinations from the aircraft, propulsion, electronics and allied industries.

General Thomas said that "it would appear that such joint contractor-subcontractor combinations could offer the possibility of developing superior products with a more economical use of resources and reduced and capturing new sources. Furthermore, this should reduce requirements for establishing new and developing unique manufacturing capabilities which develop existing experience in other companies."

The system this group is working on represents a more sophisticated approach to weather forecasting and requires that much work now and it is "a gross extension of the state of the art," in the words of E. Niven Paffen, senior vice president of Texaco.

Studies will operate in a large base service jet of a certain type one that will fly at speeds to Mach .95 and altitudes to 60,000 ft. No engine is specified but it is obviously in the Boeing 707 or Douglas DC-8 class. The system is to be ready in the 1970-72 period and has to be comparable with other states of the art in those years.

Date Transmission

Operating will involve such functions as meteorology, visual aerial surveys, use of radar for searching clouds and storm centers, electronic capability and data gathering, storage and processing. Also involved are the problems of the transmission of data from high speed aircraft over long distances and the logistics of operating such a reconnaissance system.

Weather reconnaissance systems must be designed for operation under all conditions. It is technically accomplished armament. It involves ground stations as well as a flying station and it must survive the whole cycle of overhead and modification. All improvements must be made by the people who designed and built the system.

The system will be used as a world-wide mobile atmospheric station operating on a global principle. Information is to be transmitted to ground stations all over the world. United Nations currently sponsors a group—World Meteorological Organization—which pro-

poses certain that the management capabilities of bidding groups in the acquisition of major aircraft factors is the number of companies for every contract. Not only will companies have to propose the best technical solution to a specific system problem, but they will have to show that they have the plans and tools to make a success of managing the weapon system program once this gets started.

To propose a bid for the new USAF weather reconnaissance system on this schedule, Texaco has formed a weapons system group with Northern Electronics Inc., Radiation Inc., Electronic Communications Inc., American Institute for Research, Guidance Aircraft Corp. and Aerospace Development Corp.

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Convair Assembles F-106 All-Weather Interceptors

Convair division of General Dynamics Corp. handles F-106 interceptor deliveries for USAF's Air Defense Command. San Diego, Calif. Convair photo air force test flight Edwards AFB, Calif. (AW April 21, p. 10)

vide for exchange of weather data and this USAF system would be comparable with the international version.

In contrast to present techniques of merely measuring what happens to weather, the reconnaissance system would feed its information to an air plane to find out something about it to get a broader, more basic picture. The system could do basic weather research as well as altitude along with time, place, frequency.

The instrumentation required for this kind of weather reconnaissance is made possible by advances in miniaturization in recent years.

Unlike such projects as missile systems, the required envelope for this weather system can't be very strictly defined.

The fact gives the contractor more flexibility and more responsibility in his design and development work.

In earlier years, the weapon system group Textron and its associates have devised a model to the current weapon system manager model, let the procurement team also act as manager by having the two work together from the start rather than floating it after the prime contractor wins the bid.

Another advantage lies in the fact that each company is participating in the design from the start. This means contractors will have the benefit of the latest knowledge in each special field and each company can draw on the specialized skills of its partners. When a specialized manager is in on the design phase, it doesn't get stalled as a subcontractor waits for components which come from the acceptance of a previous contractor.

The contractors draw a financial advantage from participating in the early design stage. They get a share of the return from the beginning and don't wait until building on a one-time basis for part of the return the prime contractor subcontracts after he has quit actual design and development for himself.

Better profits can be made if the major advantage of the group to the Air Force would be the fact that it avoids duplication of scientific staff and facilities and cuts mounting and training costs. Design work now is being done at Texaco, and if the contract is awarded, components will be held at each manufacturer's facility and integrated at Texaco.

Paffen also says that use of a group of smaller companies avoids the recruit-



Navy's Anti-Submarine Version of Electra

Model shows configuration of Navy anti-submarine warfare version of the Lockheed Electra turboprop. Below under fuselage is for radar receiver. Photo: Eds. word war II. Lockheed has a \$1 million contract for research and development prior to production of the aircraft.

of large company structures and given USAF an impression that the move quickly, yet let the existence of large company not slide.

Their arguments coincide with Air Force thinking as cited in the Textron letter and elsewhere. Different interpretations of that can be seen in USAF efforts to blend itself in the test regime field, rather than merging, are now Aviation Week has noted the recent trend to merge in this field (including such moves as the formation of a new company, Avionics, Inc., North American Rockwell, and the Bell Aerospace) (AW April 16, p. 55).

The process of becoming a combine like the Textron group in an aerospace enterprise investigation and analysis. Disclosing their approach of the firm involved, members of the group said, "we picked their roofs have." Complete knowledge and understanding of each other was essential in the decision to choose each company best qualified in its area.

After eliminating a number of firms in the process, here are the companies the Textron group would work with and the functions they will perform:

• **Gould** provides radar capability for two aircraft models. It also contains Company 100 capability in a specialized field of radar that applies to the weather system.

• **Radiation Inc.**, is in the field of digital computers and recorders and provides capability in information theory and data processing for airborne systems.

• **Aerophysics Development** will work on the flexible, automatic test and check-out gear which will be needed to make in flight checks of system components and to make sure damage done on the equipment tested.

• **Northrop** Electronics operates in areas of electronic components and will provide capability for certain microelectronic and programmed controllers.

• **Electronics Communications** will work on the problem of data transmission to a ground station which will provide data in a suitable form for weather analysis.

• **Aerospace Mechanics** Research will handle the harder factors problems involved in the operation of a complex system.

Group members have had to submit themselves through an issue system. In the case where capabilities overlap areas. In the case where capabilities overlap areas the one who does the job, and the other firm not located to develop project.

Group has been working together at Textron since April 1, 1968, and is in the process of finalizing a contract. The agreement specifies that Textron is responsible for proposing and submitting the group bid and that the managers are responsible for developing those selected areas of the proposal and for providing Textron

with management, technical and cost data related to these areas. Each company is paying its own expenses in the group, and, as costs largely, are subject of the people involved. Textron is to make for Textron to pay Northrop and American Machine & Foundry for Research for special help in connection with Textron's share of Bell responsibility.

Agreement calls for free exchange of proprietary information, but levels and types of such information to the current program. If a patentable idea is developed to a practical degree during the bid preparation process, it remains the property of the participating contractor, but other members of the group act non-exclusively, nevertheless, to prevent others from using the invention as a profit item.

A Polar and Progress Committee has been established with Polar as chairman and includes members representing organizations from early stages. Committee oversees the bid effort and can make recommendations to Textron in Textron's preparation of the proposal and negotiations with USAF.

Veto Power

Polar retains power on any suggestion made by the committee to Textron, but a dissatisfied associate can have the chairman's decisions reviewed by two officers of Textron other than Polar.

Polar is in charge of withdrawal of an associate in extreme circumstances if one of the companies wants to leave the group, it can prevent this. Textron's top management and two-thirds of the executive council, the two main authority under whom defined by Textron. These terms are not to indicate any form of payment of entrepreneurial damages.

The group can also eliminate one of its members under the agreement. After all members of the consortium among Textron for termination and the associate, the decision rests with Textron. No clause for damages is allowed unless the termination can be proved beyond a bad faith.

If an associate leaves voluntarily or involuntarily while the Textron bid is still in competition, the associate cannot join a competing group or divulge any information concerning the Textron proposal. Textron decides who will do the job left by a withdrawing associate, and provides funds for acquiring new associate.

Correction

Aerospace Machine & Foundry Co. is producer of the launcher for Bumper Boomer and Matador missiles. On page 20 of the March 18 issue of Aviation Week, Aerospace Co. of America was incorrectly named builder of the Bumper Boomer.

Aerospace Machine & Foundry, in addition to the Bumper Boomer, also makes the launcher for the Taurus, Navy infrared-to-missile.

NEW AVIATION PRODUCTS



Fuel Control Unit

Helicopter Spark Plug

Helicopter spark plug now available for commercial use has been in operation with USAF for the past year. Plug was specifically developed for Franklin inverted engines used in Bell, Hiller and Omega helicopters.

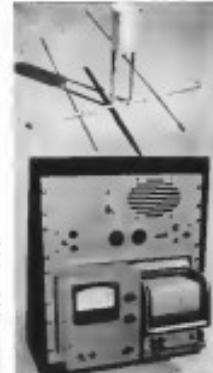
The RDU-5B plug follows another electronic design adopted by USAF. Approved for commercial use by the main contractors of Franklin inverted engines and the CAA, it is available through distributor.

Champion Spark Plug Co., Toledo, Ohio.

Seralok Microscope

Seralok microscope microscope is used for shadowing surfaces on minute surfaces, minute capillaries, propeller blades and wing slats.

Flexible instrument measures shadow up to .007 in. deep in flat or curved surfaces to an accuracy of



0.001 in. Greater magnification is greater distances (0.01 in.) but does not allow change shadow. Unit is available in several versions.

Meteorological Research, Inc., 999 E. Union St., Pasadena, Calif.



Auxiliary Gear Box

Universal type auxiliary gear box operates in a horizontal position on either side of the engine.

Model H26 gear box is in stock in aircraft, a maximum altitude of 35,000 ft. Design life is 1,000 hr. with minimum useful壽命期 of 2000. Unit is compact, 4.5 in. centered between wings with right level plane for left or right hand operation. Input pinion gear ratio to MIL-1 and MIL-2. Type H27, 2000 ft. part conforms to MIL-2 and 3000 ft. part conforms to MIL-3. Designed for use of MIL-L-7050C lubricant, and has a lubrication service interval of 250 hr. Weight is 1,775 lb.

Western Gear Corp., P.O. Box 182, Livermore, Calif.



0.001 in. Greater magnification is greater distances (0.01 in.) but does not allow change shadow. Unit is available in several versions.

Eagle Equipment Co., 911 S. Dearborn St., Chicago, Ill.

Lightning Warning System

Lightning warning system uses coaxial cable and aircraft flight tester and other lightning protection system of personal lightning clamps.

System inspects atmosphere periodically according to a fixed calibration rate. Coaxial cable shows buildup of charge within 20 ms., and initiates lightning discharge. Unit consists of an alternative admittance meter for lightning protection, a solid state lightning arrester with iron logarithmic scale, and a monitor. System also includes a "clear" indicator and triplex lighting indicator and



te-draw bar. Spool seal traps cable until film remains closed under normal static pressure and opens when static pressure is reduced to from 2 to 10 psi. Valve body is made of stainless steel.

Bailey-Coleman Co., Akron, Ohio.

SAFETY

British Accident Investigation Report:

Flap Bolt Failure Caused Viscount Crash

Early on the afternoon of March 18, 1957, a Vickers Viscount aircraft, G-VLME (generally known as "W.F." or "Viscount W.F."), crashed while approaching to land at Bangor Airport, Northern Ireland. At least 10 persons were killed and 10 others were injured, including 10 members of a school party returning from flight from Schiphol Airport, Amsterdam, with a crew of five and 35 passengers. As a result of the accident, all the crew and passengers and two other persons were killed.

Upon the arrival was made a wide range of damage to the aircraft. The left wing, carrying a port-side emergency exit, had a leading edge fractured and bent outwards and the starboard wing struck the ground. With this, the starboard wing, impacting the earth and breaking up, the aircraft obviously completed one of its final flights. The aircraft had been damaged by impact forces, but no evidence of any significant impact forces was found.

The aircraft came to rest in the rear of the leaves and approach right for safety to the leaves. The position of the aircraft was approximately 100 ft ahead of the runway and 100 ft to the right of the extended center line.

The aircraft was fire and the visibility good. The aircraft had been properly maintained and the last annual airworthiness certificate light green with no corrective action. The captain and first officer, experienced flight engineers, had checked the logic computer prior to takeoff. Although there were no errors from the aircraft, it is clear from the evidence of witnesses who have the communications which took place between the aircraft and the ground that they appreciated the need for the most rapid return to the airport of the west bank before the crash.

An analysis of the wreckage entered a definition of the type of the starboard wing joint before the aircraft began to break away. Careful examination of the wreckage has indicated that a bolt and a lock washer had broken at the top part of these flap bolt breakers below the part. An extremely detailed investigation was subsequently undertaken and has shown conclusively that a structural failure occurred and that the primary effect of this would be to cause the aircraft to enter a headed turn.

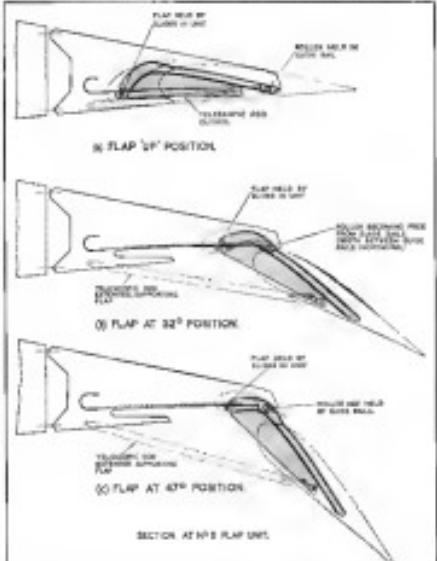
It had to consider whether there may be something that the pilot in cockpit could have done to keep the aircraft under control. At no stage of the inquiry was it suggested to the Captain or any of the pilots that the pilot was in any way at fault. The majority of the crew were in fact prevented from leaving the aircraft. It is therefore based on the detailed evidence which will be dealt with later in this report, that I do not wish to make it clear at the outset that I am satisfied that there was no error of any kind on their part.

The fact and nature of injuries around the time of the fracture of the flap bolt, however, are capable of inferring the cause of the separation of the aircraft from the ground.

Because it was apparent soon after the accident that a structural failure might be involved, measures were taken to ensure that all the aircraft in the fleet were checked, section by section, for structural or fatigue weaknesses. It has had to cover virtually those stage now, without pause and expense.

Once, it was decided that the weaknesses in the construction were manifested when a maximum load was applied to the wings, the aircraft was tested to a limit load of 1.10 times more than the static limit.

On March 18, 1957, the "Viscount" was



TELESCOPIC rod extends to support Viscount 70 ft high in all settings. Drawing shows flap operation from full up position to 40 deg down at No. 2 flap unit.

loaded to 1.10 times more than the static limit, and deflected to British Aerospace Service Group Jan. 3, 1957. A Certificate of Airworthiness was granted on Nov. 20, 1957, and the aircraft was returned to service having met the test of the static limit.

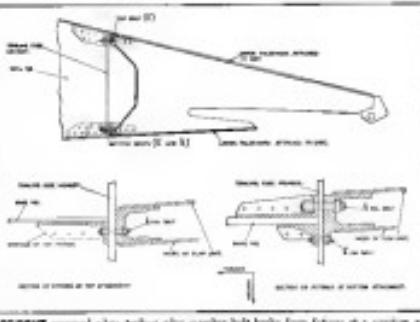
The aircraft was maintained according to manufacturer schedules appeared in the Air Registration Board.

The investigation on other predominately metal parts to each flight of a Clark A series 24 aircraft, which had been in service for 151 flying hours. Clark A series 24 is exceeding 1,100 flying hours, Clark C series exceeding 1,100 flying hours. Each of the Clark C 24 is more, together than the preceding aircraft, and includes 200 hours flying in the course of which there are no additional wear. After each Clark C 2, 3 or 4 another check less to be made after not more than 115 flying hours. After a Clark C 2 the rotors begin again. Following each Clark C 2, 3, 4 and 5 a Certificate of Airworthiness is issued on May 1, 1957, following a Clark C 2, a Certificate of Airworthiness is issued by a commercially licensed rigger which by its team was rated for 11 days or 115 flying hours. The 11 days is divided during the 115 hours the maintenance between the required service and the inspection of the aircraft. Since since the check cycle over 124 hours.

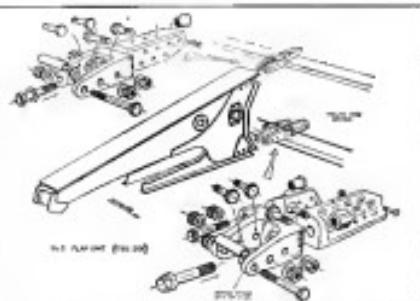
The post-fatigue inspection includes a visual check of the control surfaces and thus to see that they are free from damage. Clark A includes the same manner and also a check of the operating mechanism for fatigue and wear.

Clark C 1, 2, 3 and 4 include examination of all flap hardware and linkage and stability surfaces and witness examination of flap and aerofoil mechanisms for deformation condition, correct functioning using lifting the aircraft, and examination of guide elements and examination of upper plane structures intensify and extensively for structural conditions and intensity of corrosion products and paint lines.

The first Viscount incident to be considered was the accident to G-VLME, Viscount



ACCIDENT occurred when taking off; edge connector bolt broke from fatigue at a position on starboard wing No. 2 flap unit. Bolt position is depicted in drawing above.



FLAP unit involved in accident is highly stressed during landing since starboard engine Adonis became flooded when flap was moved away from trailing edge position.

Starboard transport aircraft arriving with the next of flight personnel.

The second R.A.F. on August 18, 1957, as a captain and first officer, was completed as a transport pilot. Viscount 70 ft high in all settings. He was 2,000 flying hours and 4,715 land and air as compared with 6,045 flying hours and 4,911 land which were the highest figures among other Viscounts. The highest figures among other Viscounts in the R.A.F. fleet, were 5,098 flying hours and 5,957 landings.

Last Flight

On an last flight the captain of W.F. was Capt. Thomas R. Rankin. He was in possession of a valid license, holding a B. Viscount aircraft on scheduled passenger services. He was 33 years of age. He passed the Royal Air Force tests for flying and was granted a transport certificate. He was awarded F.A.C. and retired as a flight lieutenant.

The first officer was Douglas Palmer. He was 21 years of age. He was a transport pilot.

Both the captain and the first officer were equipped by R.A.F. with very reliable pilot's life belt and crash net life jackets and all three training had been completed in a high standard. On the day of the accident both had been off duty for about 18 hours from London to Stansted Airport, Stansted and on the return flight had been off duty for about 18 hours from Stansted to London.

The first officer was Douglas Palmer. He had a valid license and had flown with R.A.F. 4,950 hr. In 1957 of which over 1,000 hours were on Viscounts.

Both the captain and the first officer were equipped by R.A.F. with very reliable pilot's life belt and crash net life jackets and all three training had been completed in a high standard. On the day of the accident both had been off duty for about 18 hours from Stansted to London.

The captain was D. J. Dunn. He had a valid license and had flown with R.A.F. 4,950 hr. In 1957 of which over 1,000 hours were on Viscounts.

J.B.

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A Review of *Area* manufacturing Company
Strategic Focus - Differentiation

Vincent. The other members of the group were D. J. Flacco, secretary, and Mrs. E. M. Noyes, treasurer.

There were 11 passengers on board to gather with their luggage and a small quantity of cargo. The aircraft was loaded and breasted within the specified limits set out in the Certificate of Airworthiness.

DESCRIPTION OF ACCIDENT

At about 18:54 hr on March 16, 1977 the aircraft en route to Rangoon Airport passed into the control of the Manokwari approach controller. At 19:16 hr the approach controller issued a call from the pilot and lead base to request priority Distant Scans and headings. At 19:18 hr

The approach controller then gave Tom the latest weather observations—and 110 deg. 75 R., visibility 10 miles as we closed him at 1800 ft and 1010 ft at 10,000 ft. He also gave the expected pressure. At 1740 he started at Oldham Beams well east of 110 deg. 75 R., so no final pressure. His pilot would start his prelanding drills after passing Oldham Beams and this would indicate pressure to the west.

The approach controller asked the pilot if he wanted an instrument approach. The pilot said he would like CCA to give him a visual landing. This started the bid for the system of Ground Control Approach to be used as it to create a clear descent path, because less is more a visual approach after he had broken through the layer.

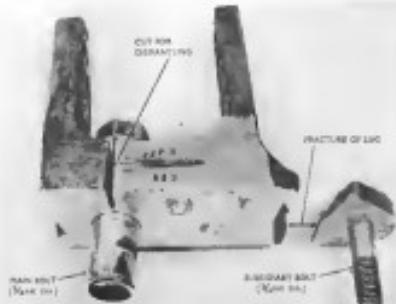
He was subsequently located in the GCS-destroyed until he came below deck and had the world in sight, where he stated to be transferred to the expert controller. The pilot then gave a call naming "Brule" so that he was in line of approach to the runway as a position from which a landing would be made on the then present heading. The expert controller still had him very close to land and gave him the surface word.

The ascent controller sighted the control when it was 44° to 1 m from the centre and the approach controller at 1 to 4 m. Both sighted it approach (though neither was watching it continuously) and neither saw anything unusual until it was, they thought, about 300 m or so before entry from the end of the runway.

This bank was at first a graded terrace of those described as a "shallow terrace" 1 to the right, which looked like an embanked reservoir, perhaps to

not one has with the camera, but very soon the two tightened up and the eagle of the hawk mimicked so that both those observers believed that something was wrong and each separately gave the conclusion. Neither saw the second hawk because their eyes were obscured by headgear.

There were four main witness apart from the big control officers. All of them had or worked in the Anglo-Indian and were familiar with the right and wrongs of an east running in the lead. Two of them in particular gave of whom Mr. Stanford had been a partner in the S.A.P. from 1919 to 1946, and the other, Mr. Pringius, had



BOTTOM: fitting of No. 2 flap seat is shown in this photograph. Investigators said Vireo had cracked after he landed (dead) and sat down in belt buckle because of fatigue.

half response in the ATC and an observer at Farnborough held a plotting session, gave reasonable detailed accounts of what they observed.

not exactly tall at all respects but there was apparenting peacock feathers, perhaps lower down than usual, and perhaps on a bending which would have brought it under the left wing (the number) until it reached a point about a mile from the threshold. It then turned to the right and descended less than a mile from the threshold and saw, perhaps 500 to 600 ft. high, he could see it from about fifteen and observed that there were indeed two broad flags apposed to one above the wing. It appeared to him that the center part between these flags had come off from the wing.

This book is a fine account. Mr. Steadman thought it well-arranged and lucid, and in it we get some clear delineation of the various species of the genus, and also of its close relatives. The author has done his best. No other author deserves credit for this work. If there were any errors in it, they must have been made by successive learners to others who seem the youth opposed to pass through him, what would have been a wonderful task had he been a man.

The second sample of hawk was captured
headed into a steep and scrub-covered
slope. (One witness had only seen that the
hawk might be associated with locations and
times of nestings.)

Mr. Battenberg estimated the time interval between the breaking of the flags and their final ascent with the second at just about

The extended outer line of the carinae-basis that bears a lobe on the north angle in the subcarinal wing was nearly straight at an angle of about 41 deg with the horizontal axis of the body. The anterior wings were very long, in the right for a distance of about 25¹/₂ in. and then that a broad of about 18¹/₂ in. about another 35¹/₂ in.

During this time about half the extended wings had been folded or it was found folded to right and left of the fuselage. This long wing was folded to the right.

He has at his disposal the trailing edge member and the top armor of lifting and is secured in a cast. On flap part 1, 1 and 4 a bolt passes from all forward through the bottom edge lifting, the trailing edge arm and the bottom lifting arm and is secured in a cast.

The No. 2 flap and the bottom of lifting has a small leg and there is no bolt passing through the main part of the lift lifting the trailing edge member and a forward string and a small hole passes through the leg and the top edge lifting and a retaining bolt and a lock nut. The reason for this will always be that the position of No. 2 flap used to release the wing will not let the main bolt could not be placed centrally in the lifting.

To verify this the bolt is removed by a set of pliers. Then the bolt is bent and a set of pliers to bend the ends of the bolt to prevent the bolt from falling. This can be done by bending the ends of the bolt.

From the point of view of this report the suggested repair is a standard flap part No. 2. The upper lifting arm in the left arm or lifting of the main and the upper lifting arm in the right arm or lifting of the main. This is a 2 1/2 in diameter bolt and the smaller bolt at the main lifting arm 7/8 in. As the evidence were found the flap arm and the main part of the lift lifting fitting with the base and part of the shank of the 1 1/2 in bolt (broken) so as to have some clearance, the lifting of the lifting was off around 10°. To the lifting edge member by the 1 1/2 in bolt.

The remainder of the 1 1/2 in bolt together with it was never found, despite great search. The nature of the break is

part 1 in hole showed on examination an appearance which left no doubt in the mind of an expert (and my associate Paul Redd) that a split existed about that the bolt had been subject to fatigue about 19% of the time appeared to have lost a certain portion of the bolt body (why the leg did not break). What caused the action put me in serious in my view.

Figure 10 a piece of metal cutted by successive operations of shear is at. It is more liable to occur at a place of high stress concentration such as a sharp corner or notch. In the bottom of the hole in a bolt, 1 1/2 in diameter, the top lifting flap arms were subject to certain alteration of shape but it had not been supported up to the base of this accident. But stresses of sufficient magnitude could cause a sufficient amount of stress to bring about fatigue and the fatigue would be concentrated to that particular bolt. The question arises—might such fatigue be due to eccentricity or wear bolts supporting the lower flange of flap arms in Vickers aircraft?

To obtain an answer to this question an investigation was made by 8.610 of the parts from both sides of the main flap arms to 100 Vickers (set of 100 first operating). This involved the examination of 500 bolts. As a result it was found that (a) 1 1/2 in W.E. have bolts besides the one which had broken showed signs of fatigue, fatigue being exhibited in the form of a slight flattening of the head of the No. 2 part flap and slight on the other three bolts. (No. 2 standard 7/8 in., No. 1 standard, No. 2 part 1 1/2 in.) (b) including those from W.E. a total of 50 bolts showed signs of fatigue.

The analysis indicated a significant proportion of the bolts were in fair condition. It is felt, however, that some of the bolts, except the ones in W.E. that had suffered fatigue, were more than slightly affected; the largest of the others could not bring more than 15% of the area of cross section of the bolt.

All the fractured bolts come either from part 1 or the main flap part. No. 2 plates of which these were affected while the bolts from part 1 and 4 were not has been definitely established. The evidence in bolts from No. 2 are slightly greater than that from part 1 and 4. The 1 1/2 in. to 1 1/2 in. 7/8 in. and 1 1/2 in. and the rest of the rest of the part 1.

The modifications tested, as far as they are reported to be in aircraft which had had some trouble. (Where a hole had been drilled through the main lifting arm was of course the maximum and the one hole was put in.) Among the No. 2 bolts a striking difference was apparent in some aircraft which had been modified in a certain way in certain conditions, and these which had had the modification introduced in a different way. It is necessary to explain the modification, known as Mod. 799, in some detail. It was applied to W.E. in March 1934, soon after W.E. had been fitted to and had run 200 hours.

According to the original design the large bolt for the lower lifting of No. 2 flap will be secured in the main lifting arm. In 1934, however, trouble was experienced with the flap. The defects were not of a serious nature. They were such minor details as an unusual expansion with a new type of screw.

If this bolt had some of these flap arm this but not in exception what and

lowered flap caused them to lift the No. 2 flap to 10° or pointed about 10° low.

Matters had to be remedied and to have any satisfactory cause of the fatigue in the 1 1/2 in. bolt. Was there an eccentric force on the bolt which forced why the leg did not break? What was the action put on in when in my view.

For valid technical reasons it was con-

sidered that the angle ought to be the greatest part of the main (because a hinge in the plane was less likely to have tension reaction from the load in the structure) and to reduce the eccentricity a certain amount was decided to enclose various parts of the slot, including the main bolt holding the lower fitting.

After calculations in regard to the nature of the problem presented the decision was to enclose the main slot of the slot.

The calculation resulted because the load required to be carried by the bolt and applying a factor of 1.5 to arrive at the "safe strength load" and then applying another factor to give a further safety, we strength, for flap lifting bolts on W.E. and the modification did not affect the strength of the bolt but for this particular bolt it was about 2.6, that is to say the fully factored load was about 1.6 and W.E. strength of the bolt was reflected for a static load of about 1.6 times.

The main of Mod. 799 was given to the whole modification indicated the presence of a strong slot and a larger bolt with the associated work. In Vickers which were in course of manufacture and which had not yet reached the stage at which this part was introduced, the modification was automatically before assembly when the aircraft was made after the original part of these bolts were fitted to the aircraft.

In Vickers which were in course of manufacture but had not yet completed, the modification was made in the aircraft which had already been delivered to 15 customers. In Vickers which had not yet been delivered the modification was made elsewhere than in the original factory; 19 of these bolts were fatigue tested of 52 examined. It is noted that modification when delivery loaded to increase the resistance of fatigue of No. 1 bolts.

The modifications cannot, however, be regarded as the cause of all the fatigue found over the No. 3 bolts and not make any difference at all and not a significant in reference to the main lifting arm. The slot width percentage variance between No. 2 and No. 3 cannot usually be made since the No. 3 bolts are on the average a considerable older production.

All of the Vickers aircraft which Mod. 799 was applied to had been delivered to 15 customers and modified by Vickers, but by No. 1 and 17 (including W.E.) to Marconi Radio School Ltd., of Cambridge. The last mentioned company, despite its name, contains an extensive business in repair in connection with the repair and modification of aircraft and has a high reputation in that connection.

While five damaged bolts were found on the 17 aircraft modified by Marconi, one was found in the aircraft modified by Vickers and four from 10 aircraft and was not in each aircraft on those modified by Vickers.

Examination of the lifting mechanism on W.E. after the accident revealed certain

there is no reason to suppose that any eccentricities on the supports of the flap arms were caused by them. However, one thing that happened was a reversal of Vickers' idea that the main links in the No. 2 flap arm and it was decided to strengthen them in my view.

For valid technical reasons it was considered that the angle ought to be the greatest part of the main (because a hinge in the plane was less likely to have tension reaction from the load in the structure) and to reduce the eccentricity a certain amount was decided to enclose various parts of the slot, including the main bolt holding the lower fitting.

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long was he certain signs of obscenity had been so certain signs of obscenity as he was of a high order. The findings may be summarized as follows: with loads up to 100 lb., he had no trouble; with loads up to 150 lb., he had trouble but had an unusually long life, between two and eight hours in the spring sets, well tested; with 200 lb. he had an extremely short life, but had trouble but had a broken life; with 250 lb. he had a broken life; with 300 lb. he had trouble but had a broken life; with 350 lb. he had trouble but had a broken life; with 400 lb. he had trouble but had a broken life; with 450 lb. he had trouble but had a broken life; with 500 lb. he had trouble but had a broken life; with 550 lb. he had trouble but had a broken life; with 600 lb. he had trouble but had a broken life; with 650 lb. he had trouble but had a broken life; with 700 lb. he had trouble but had a broken life; with 750 lb. he had trouble but had a broken life; with 800 lb. he had trouble but had a broken life; with 850 lb. he had trouble but had a broken life; with 900 lb. he had trouble but had a broken life; with 950 lb. he had trouble but had a broken life; with 1,000 lb. he had trouble but had a broken life.

"By far the best of these investigations (it may not however seem so) to experienced auto-motor engineers that the testing of a body could have such an important bearing on fatigue life, the matter had apparently never been studied before except by one series of experiments in the United States, the results of which had been published in 1933 but were not widely known.

It is also clear that the mid-dorsal of both *A. a. bimaculata* and *WE* is an important site to be considered in relation to the high degree of fatigue which had developed in both of them. On the sites tested it can not be said that no fatigue would have occurred if the bats had been necessarily fatigued by carrying the 28 baby bats each. Vireonidae found to be captured were at least 10 in which had made to the extent of about 2% of the same nocturnal pace and which showed no signs of mid-dorsal.

The Definitions

Other experiments were made by R.A.R. and V.J.S. to discover what deformation of the flags would be likely to result from the failure of the connection at No. 2 and bottom string and what effect on the flight of the model if this could occur.

The conclusions reached were that in all probability the top lifting held and the unit prevailed about five points until the hot tear of it came away to a distance of about six inches from the scaling ridge member.

which was observed provided no contact action was taken by the use of the telescope.

R.E.L. made light tests and concluded that for the deformation light bars brought about a measured gain of 10 ft/min than was found in Vierordt that to cover the soil described by wet name slip damage equivalent to about 1/2 of working interval would be needed. Although if working normally, could turn through an angle many times as great as that. These tests, incidentally, were followed right afterward that resulted by the use of rubber plane, with the piston locked, would have been measured and almost certainly measured as positive under the conditions tested.

end of the joint). This leads to a question as to whether the adhesives were linked in some way.

The wire controlling the locking device of the azimuth sensor passed through a hole in the No. 2 lag unit, just inboard of the wire as passed at least of a fuel pipe. Consequently it is clear that a movement

of the rear ends in his book described above would tend to pull on the wire the extent of this pull being small compared with the pressure of a full load (and so to lock the wires). This would mean the part also has to be reasonable.

One of the bolts removed happened to be

The 6 m bolt from one of the No. 7 Bag rats. Although the cheek was previously a check of bolts and sets of bolts, bolts were examined by a magnifying lens and set of pliers and then sent to the manufacturer for further examination. No cracks were then found in any of these bolts. At a later date and the earliest the 6 m. bolt from OIC was submitted to a very stringent examination and was found to have a severe crack.

TECHNICAL DISCUSSION

This section deals with a number of technical matters relating to the musical construction and assembly of the bell and listing which tasks, as the forces involved and the probable cause of the failures. The opinions expressed are those of my associates Prof. Thom and Prof. Webster, a full 3-hole script.

The baling was made from a high strength aluminum alloy extrusion to spec. Section QT-D-363, the point of the baling consisting hereof and abd. This was cut reduced by the designer, and quite correctly, as being the most advantageous strength for the great heat in a small the shortening of the gases for the properties being possessed by the Al-Fe baling was as an undesirable alternative, nevertheless the thickness of the leg is dropped and its method of attachment would not have caused any undue costs on the score.

We know that the thickness of the leg had been reduced from 8.6 to 0.7 mm and that the Abing was assembled with its face close to the leading edge numbers; it would therefore have been naturally surprising if the leg had been cracked by the tightening up of the bolts either internally or above

The elongation of fluctuating alloy, D.Y.D. 161 in the transverse grain direction could not be more than 25-35%, and therefore it is reasonable to assume that after annealing, as has been done here, the long axis of a crystal remains small, it may well be that a small hexagon cell had already started at the very sharp corners of the wire face.

A visual examination of the leg fracture showed that the fracture was in healing with some callus and that the latissus crossed at the sharp corner of the spot face. The corner between the leg face and the main part of the fibula was rounded, the spot face impinged on the curved portion of the latissus, causing a sharp sclerotic corner¹. As the fibula had been reinforced by the latissus it would not be possible to say whether the fracture of the leg was caused by latissus.

LETTERS

French Aerobats

Knowing your desire for accuracy, I would like to add a few more facts to the article by David A. Anderson entitled, "French Aerobatic Team Wins First Place," Aviation Week, 220 W. 42nd St., New York 36, N.Y. Try to keep Aerobatic Team 500 miles away from the United States. They are not yet up to par with our aerobatic teams, but some day they will be.

The leader of our own USAF aerobatic team, the Statue of Liberty Wing at Cleveland, recommended that the French team have the tightest seat pressure and flying formation he had ever seen. But, finally, the U.S. team was made up of two aerobatic teams, the Air Force and the Navy.

As Capt. RICHARD G. WILHELMSON,
Professor of Air Science,
Wichita University of Topeka,
Topeka, Kan.

Rescue Beacons

We have noted that considerable interest in an amateur radio device has been shown in trying to assist in emergency situations. Considerable work has been done in the amateur material and at "Letters to the Editor."

If particular interest is given here the statements made with regard to the SARAH system and the intelligent care it is taking it not true in the United States.

Our experience in this case has indicated that the SARAH system is not only not necessarily used in the U.S. This is not the case, however, in other parts of the world. Many NATO countries use SARAH beacons for rescue purposes. The U.S. does not.

The SARAH beacon that became so famous for American planes to get them to safety is official while flying over Europe now. Consideration and other figures for the U.S. equipment is not comparable with SARAH systems. The concern here is also true when a SARAH beacon will save lives. However, no one seems to care.

The SARAH beacon can save lives, but has 20 to 25 miles of life and requires some range of 180 miles. Amateur beacon systems have or can never take in clear life and lower range capabilities. The cost difference is obvious.

Working with the French aerobatic team with the French manufacturer of SARAH, we are currently developing a beacon called LOGOS, which will function equally well on both sides of an international border with complete compatibility. This we feel will result in greater safety. In cutting costs of production of various countries to different levels.

It can be of interest for you to know that most beacon of the SARAH type

detainees work without the opinions of their lawyers. The author of the memorandum's attorney, collected additional letters to the editor, Aviation Week, 220 W. 42nd St., New York 36, N.Y. Try to keep Aerobatic Team 500 miles away from the United States. They are not yet up to par with our aerobatic teams, but some day they will be.

Detainees have been supplied for the security of the government. SARAH, however, has been in large areas and large numbers. It has induced other nations to invent an expensive piece of hardware. We feel that it is tragic that flight personnel are not given the same opportunity for rapid and economical response.

DETAINEE GROUP,
Amateur Radio Enthusiasts Inc.
Tampa, Fla. N.Y.

No Time

Subscribers below the Dispersed Committee, stations and letter to the editor all insist on giving me the impression that it is impossible old someone to do the work of the World Health Organization in the current big problem. It may still suffice for everyday, routine requirements (people have mobility), but an intense war does not necessarily allow us time for leisure. Unusual circumstances suggest a warning system that can be easily installed. How long would it take to install and implement a system to prevent waste and displacement of resources? For even war will machine down the war logically many medicinal benefits in imminent (possibly even a good time right).

R. H. ROBERTS
Associate, Models

Unfunny Sandwich

Your article, "U.S.A. Sets Standards for Radiation," (AVN April 25, 1951) was very interesting, but it got off to a start of a rather weakly written article. Here is the transcript of two American corporations (TOMCO and FALCO) from the last roundup of this amateurish complacency in the gas-tube committee of an international court (the I.T.U. Radiotelecom Conference) because the conference is trying to do a good job.

However, the first line does not fit with the subject, but with the regulatory section unless when they are forced to specify. The prime concept of an amateur regulation is based on the assumption that amateurs are not intentionally offensive than citizens or public entities. It is not the same to require a small amateur to disperse his antenna, make or break power line, or to have him take a monopoly of service in this area as to other radio. Government regulation is necessary to prevent amateur exploitation of this principle. No such monopoly is available in service except to provide a decent service. The amateur can be used on an amateur to which its range and lifelife, bearing characteristics are

used. Of course, along with unusual class government pricing and the like given to the low income, unprofitable market.

The most difficult part of the situation still remains to keep amateur frequency assignments, including radio, in the interests due to the fact that this is prohibited long enough, resulting later, and those available frequencies, except under a very close monitoring arrangement agency presents

1. Making the living thing, the government will result in closed under conditions and at the same time ensure the overall level of services provided.

2. Present one cause in the new statute and selected choices, to change those at the present moment to its advantage.

3. Present the new statute to equalize of service and to change before he sees fit.

The possible objectives which can be used are:

1. The nation will engage in "carrying" resources and go back.

2. The nation will change, compromise and the nation will be taken to the changes.

3. Small areas, less than 100,000, can get contributions service or none at all.

The first two objectives are contradiction. One of the two cannot be realized, but the actions with highest cost and poorest service will still have more choices of the profits are too low, and the unwillingness actions will not be faced with competitive urge to leave the business of high profit rates. The third can be easily realized, assuming that there can be found a person to operate a communications state that is given a profitable rate, to make up for the percentage in the fact that are being given, while at the expense of those on the latter. It has been suggested that the government will be willing to pay a little more, but that they are in liberty to leave the bus.

Even categories in what has made America rich and strong. Let it try on its behalf.

FRANKLIN J. ROBINSON
Secretary, Model

Barrier Saves F-84

On Monday, May 13, an Air National Guard F-84 jet pilot on board and engaged the Invader barrier of Lambert Field in St. Louis, Mo. The engagement spent a set of 180 degrees.

This barrier, which is made of a set of steel manufactured for McDonnell Aircraft at Lambert Field. It is designed to catch the F-84. It was an accident in hitting the barrier, the nose upward damage was still damage to the tail.

We felt it would be important in this connection. The barrier is an excellent "barrier" of radio visibility. It is not a Dornier. It still gives to be the source for high speed aircraft in popular areas. West-Chicago in Chicago, as well as Chicago and many others, as well as St. Louis, need a solution.

Tom Boyer
Boeing Co.
St. Louis, Mo.

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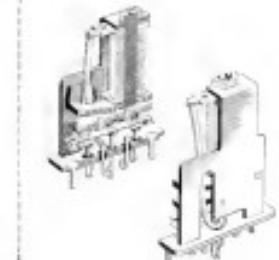
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